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NOTES ON SHIPS AND TORPEDO BOATS.

By Ensign W. K. Harrison, United States Navy,
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ARGENTINA.

JOSÉ GARIBALDI, 6,840-TON ARMORED CRUISER.

(Page 61, No. XIII; 9, No. XIV; 13, No. XV.)

Battery.—The machine guns mentioned in No. XV are Maxim 11-millimeter (.433-inch) and are mounted in the upper fighting top, forward side; in the same top, after side, are mounted two of the 1-pounder R. F. G.; two 6-pounders are mounted in the lower top. In addition, the ship carries two 75-millimeter (2.955-inch) Krupp guns for land service. It is said that the 6-inch guns train only 130 degrees instead of 150 degrees. They are protected by low shields, without tops, 3½ inches thick, in addition to the armored side of the ship. Twenty-five shells for each 6-inch gun are kept at hand in racks. A peculiar revolving rack for holding projectiles is fitted in each turret. The rack is concentric with the turret and moves with it, but is also capable of independent motion, which is imparted by mechanism operated by hand. It is below the turret floor, and access is gained to it by raising a lid below and directly in rear of the breech of the gun. The rack is divided into sixteen compartments, each of which holds two shells, and as each compartment is emptied the rack is revolved to bring the next compartment under the opening. A crane, with drum and wire rope, is used for lifting the shell from the rack to the gun. When the rack is emptied the supply of shells is whipped up from the shell room by hand.

Main engines.—The main engines are side by side in separate water-tight compartments, and are triple expansion, vertical inverted, direct acting, designed to indicate 13,000 H. P. when making 116 revolutions; diameter of cylinders, 42½ inches, 63 inches, and 93 inches; stroke, 46 inches.

Boilers.—There are eight main and one auxiliary steel, cylindrical, single ended, horizontal fire, tubular boilers, the main boilers being arranged in two water-tight compartments with fore and aft fire rooms.

Forced draft is obtained by the closed ash-pit system, the air being supplied by eight blowers, four in each boiler compartment. Diameter of main boilers, 15 feet 2¼ inches; length, 10 feet 5 inches; grate surface per boiler, 96.8 square feet; heating surface, 2,690 square feet; steam pressure, 160 pounds.

Electric installation.—Four 4-pole compound dynamos, each being connected to a single-cylinder vertical engine with external governor in a fly wheel and having also a heavy fly wheel on the shaft between engine and dynamo. The output per dynamo is 300 ampères at 65 volts, with speed of 260 revolutions. The wiring of the ship is on six circuits, as follows:

I. Protected circuit, includes all lamps in the citadel and below the protective deck, numbering in all 450 12 C. P. lamps.

II. External circuit, includes lamps outside of the protected parts of the ship, used for general lighting, numbering in all 250 12 C. P. lamps.

III. Motors, including all on board.

IV. Search lights.

V. Dynamo room.

VI. Signals.

The total demand for electric current is as follows:

Circuit:		Ampères.
I.	450 lamps	315
II.	250 lamps	175
III.	3 ventilators forward, each 40 ampères	120
	3 ventilators aft, each 40 ampères	120
	3 motors in engineer's workshop	43
	2 motor transformers, each 7 ampères	14
	3 ammunition hoists, each 20 ampères	60
	2 large turret motors, each 90 ampères	180
	2 small turret motors, each 20 ampères	40
IV.	1 90-centimeter projector	90
	2 45-centimeter projectors, each 60 ampères	120
V and VI		70
Total		1,347

The switchboard is of black slate, about 12 by 6 feet, and is reported to be complicated and at the same time restricts the operation of the dynamos. It contains no provision for operating dynamos in parallel, and special pains have been taken to prevent it. It appears that there is but a small working margin in the dynamo installation, and that in action the demand for current might easily rise to the full output of the plant, so that an accident to one dynamo might cause serious embarrassment.

The use of electric motors is seen to be extensive. The ventilation of the ship, save in the fire rooms, is secured by six fans, each operated by a motor. In the engineer's workshop there are three machine tools, each run by a motor, and entirely independent of the others; three motors are employed for hoisting 6-pounder ammunition; two motor transformers are used to reduce to 4 volts for ordnance purposes, one being in each turret chamber; and the turrets are controlled by motors in addition to which there is hand-turning mechanism.

The turret-turning mechanism is described as follows:

> There are two motors for each turret, one of 12 H. P., for rapid rotation, and the other of about 3, for slow movement as the sights come nearly on. Each motor is compound wound and is closed in a case for protection. Adjustable resistances are located in the turrets in a starting box at the hand of the officer in the sighting hood. Each motor has its own switch, and only one is to be worked at once. The switch of the large motor is fitted with springs, which keep it habitually open. If it is desired to turn the turret, the switch is moved in one direction and is held open as long as the rotation is to continue; on being released it breaks the circuit and stops the motor. Moving it the opposite way causes rotation of the turret in the other direction. Now, if slower motion is desirable, the switch of the smaller motor is moved either one way or the other over the contacts of the rheostat, which allows of varying the speed of the motors. There is nothing to prevent both motors being thrown in circuit at the same time by accident, which would cause injury. The small motor has one safeguard, a friction clutch on its line of gearing operated by an electro-magnet; if the resistance of the turret to motion should be excessive, this clutch is supposed to slip, allowing the armature to move and thus prevent its destruction by an excess of current.
>
> Both motors are situated in the turret chamber and work the turret through reducing gear, the final wheel of which operates in a cogged circle on the base of the turret. The only device interposed to check or in any way regulate the scend of the turret in a seaway is the intervention of worm gearing in the reducing gear, and the efficiency and safety of this is questionable. To prevent injury to the motors, two stationary stops are so placed as to operate a switch and break the motor circuits before the turret reaches the position of extreme train in either direction. Each motor is compound wound, the shunt fields of both being in series and always excited when the motors are in use. Each motor has a single straight field magnet, the pole pieces at each end being curved around to inclose the armature. The latter is of the drum type, and uses carbon brushes.
>
> The signal circuit is led directly to a distribution board in the pilot house, from which branches lead to the night signal apparatus, running lights, and to peak, position, top, stay, and truck lights, enabling each or all to be instantly controlled.
>
> Electric range indicators are fitted, and range finders are to be, but it is not known of what type the latter will be.

VESSELS REFITTING.

The *Almirante Brown* is being prepared for her voyage to France to have her main battery of 7.87-inch guns replaced by ten 5.9-inch R. F. guns of 50 calibers. The new guns will be mounted, six in the redoubt and four on deck in the positions now occupied by the 4.7-inch R. F., which are moved, two to the bow and two to the stern, in place of the 7.87-inch guns, which they eliminate. The cost of the new guns and ammunitions will amount to $200,000 gold.

TORPEDO BOATS.

(Page 14, No. XIV; 7, Part I, No. XVI.)

The four first-class armored torpedo boats building by Yarrow & Co. at Poplar, have received the names *Santa Fé*, *Corrientes*, *Misiones*, and *Entre Rios*.

Corrientes was launched October 10, 1896, with engines and boilers on board. October 18 her official trials took place. Six runs were made over the Maplin measured mile, three with the tide and three against it, the data being as follows:

Direction of tide relative to boat.	Time on run.		Steam-pressure, boilers.	Mean revolutions.	Mean speed.
	Mins.	*Secs.*	*Pounds.*		*Knots.*
With	2	12	165	379	27.272
Against	2	9	160	376	27.906
With	2	10	157	375	27.692
Against	2	15	153	364	26.666
With	2	10	150	367	27.692
Against	2	15	155	372	26.666

Mean of mile runs: Revolutions, 372.1; speed, 27.359.

After the measured-mile runs, a 3-hour run was made, the average revolutions being 372.7, which by proportion with the data found by running on the measured mile gives a speed of 27.41 knots per hour. Total I. H. P. was 4,100. Coal used—best Welsh, not picked—total consumption on 3-hour run, 10 tons 1,300 pounds. Air pressure in fire rooms, 1.47 inches of water. Sea calm. No wind.

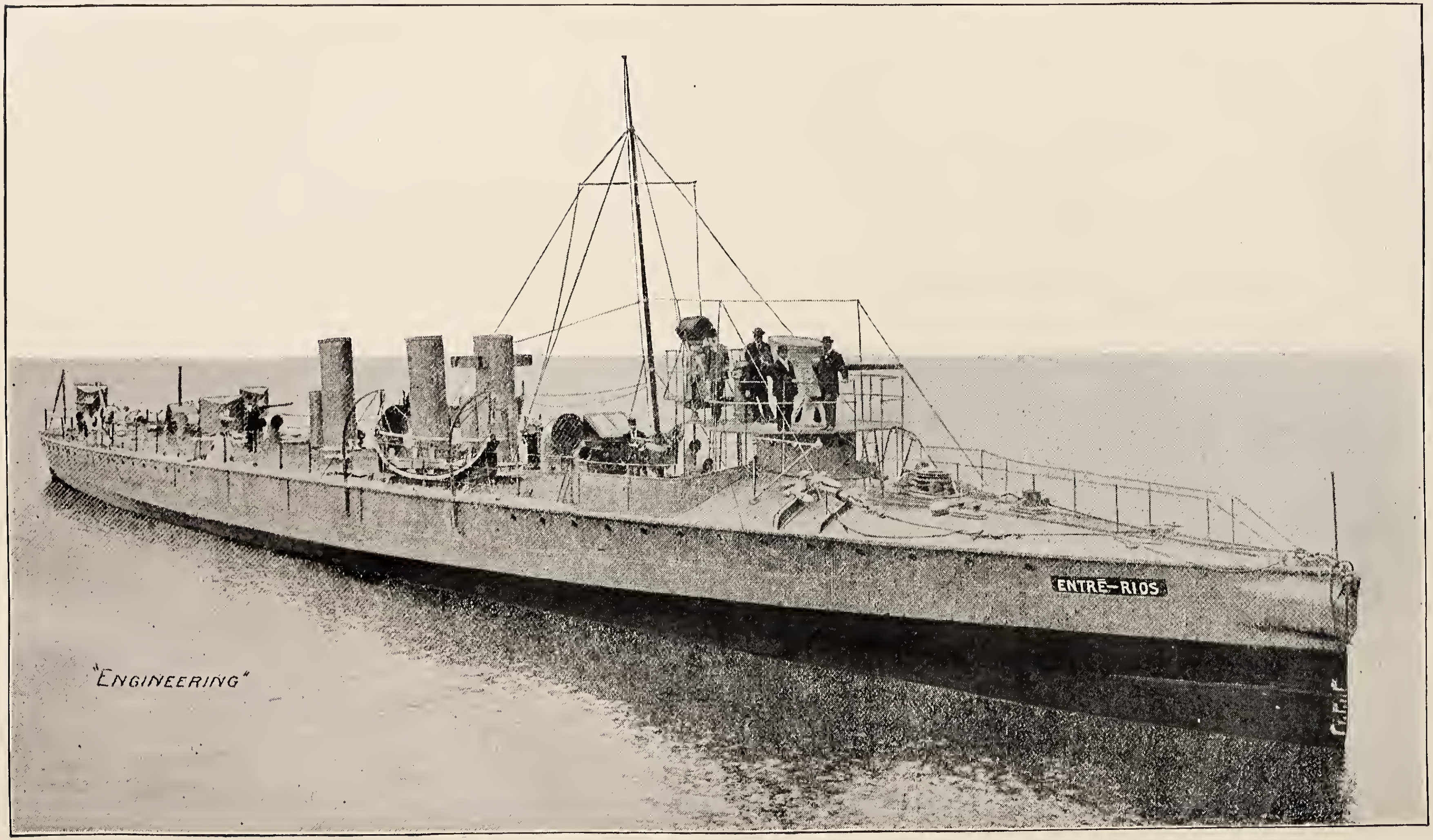
On this trial the boat carried a load of 35 tons, together with 56 persons. Her draught was 3 feet 11 inches forward, 4 feet 11 inches aft, displacement 205 tons. The following good features were noticed: Steadiness of ship and engines at every speed tried; the small turning circle at full speed, the diameter being under four lengths; the absence of squatting, and the dryness of the deck.

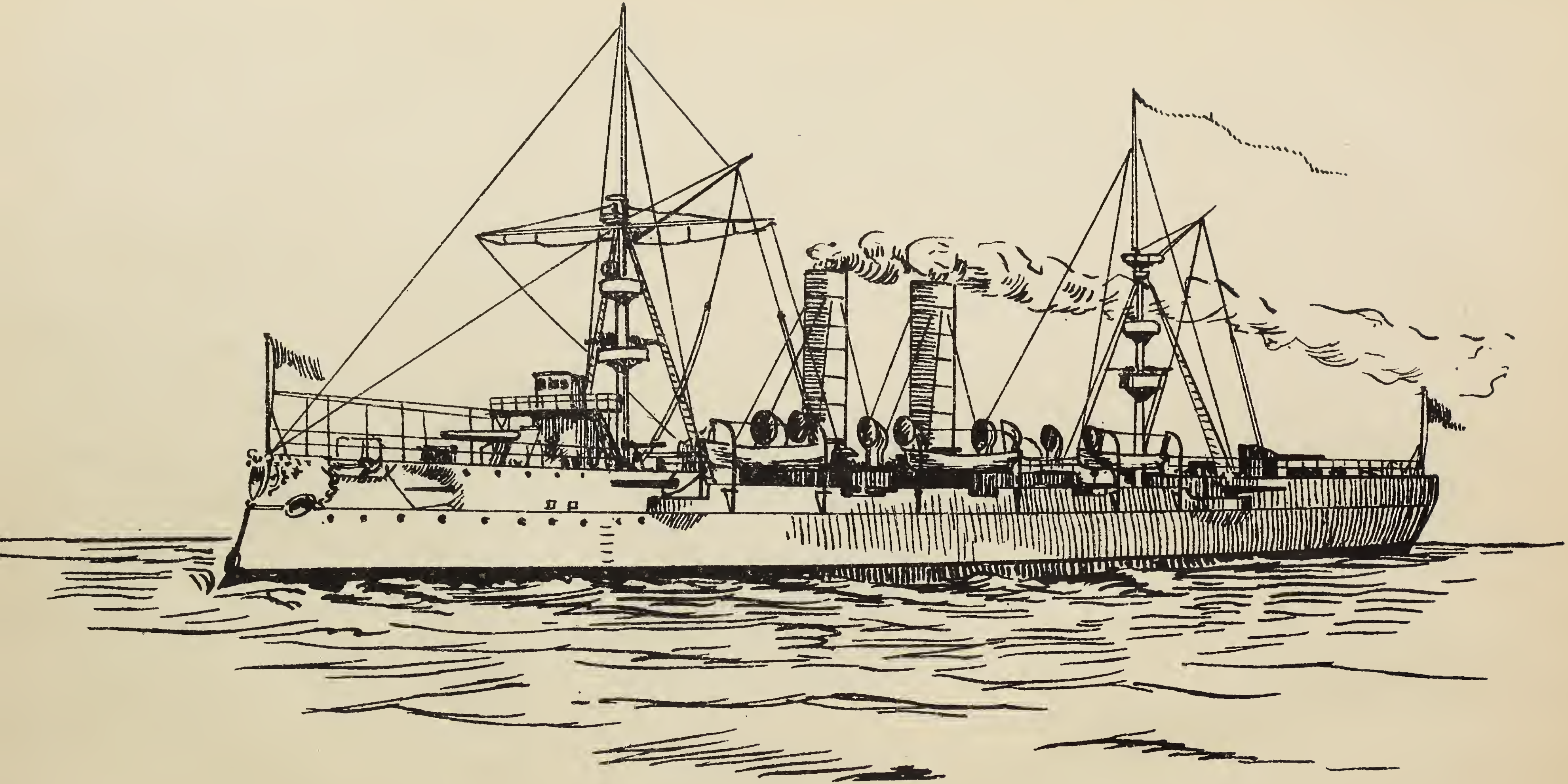
Entre Rios had her official trial September 1, 1896. These were of the same character as those of the *Corrientes*, and on the mile runs the following data were obtained:

Time on run.		Steam-pressure, boilers.	Mean revolutions.	Mean speed.
Mins.	*Secs.*	*Pounds.*		*Knots.*
2	18	148	368	26.087
2	9	150	370	27.907
2	18	150	369.5	26.087
2	10	146	364	27.693
2	23	145	358.5	25.175
2	10	145	361	27.693

Mean of mile runs: Revolutions, 365.2; speed, 26.774.

On the 3-hour run the revolutions averaged 364.8 per minute, giving a speed of 26.75 knots. The contract load of 35 tons was carried, and though the contract speed of 26 knots was exceeded by three-fourths of a knot, the boiler pressure was far below the designed working pressure of 220 pounds, so that it is evident had the boat been pushed she would have exceeded the obtained speed considerably. Consumption


ENTRE-RIOS
"ENGINEERING"



"AMAZONAS."

of coal on 3-hour run, 10½ tons. The *Entre Rios* has since made the voyage to Buenos Ayres, not calling at any port after leaving St. Vincent.

Misiones had her trial October 9. Contract load of 35 tons was carried. Average on mile runs: Revolutions, 366; speed, 27.128 knots. Average on 3-hour run: Revolutions, 365.2; speed, 27.06. Coal consumed on 3-hour run, 11¼ tons.

Santa Fé left Plymouth, England, for Argentina September 20, and on passage across the Bay of Biscay encountered a severe gale without accident. There can be no doubt of the seaworthiness of the class of large torpedo boats known as "destroyers"; it is only required that they be handled intelligently.

AUSTRIA.

STEAM TRIALS.

WIEN, 5,500-TON COAST-DEFENSE VESSEL.

(Page 16, No. XV.)

This vessel has had her steam trials. Obtained 17.6 knots, engines developing 8,500 H. P. It is reported that she is now ready for commissioning.

BRAZIL.

YPIRANGA. (Marshal Deodoro.)

(Page 14, No. XIV.)

One of the 3,112-ton coast-defense vessels has received this name.

ALMIRANTE BARROZO. (Reported sold to Japan.)

(Page 18, No. XV; 8, No. XVI, Part I.)

Dimensions.—Length, 330 feet 10 inches; beam, 43 feet 9 inches; mean draught, 16 feet 10 inches; displacement, 3,450 tons; speed, estimated, 20 knots.

Armament.—Six 50-caliber 6-inch R. F. guns, disposed so as to fire three ahead and three astern; four 50-caliber 4.7-inch R. F. guns; ten 6 pounder and four 1-pounder Nordenfelt R. F. guns; four Maxim guns; two landing guns, and three torpedo tubes.

Protection.—A complete protective deck, in addition to which the coal bunkers extend to a height of 6 feet above the water line.

Coal.—850 tons maximum capacity, giving an estimated steaming radius of about 8,000 knots at most economical speed.

VESSELS LAUNCHED.

AMAZONAS.

Sister ship to the *Barrozo*, and the second of the three building at Elswick, was launched December 4.

TUPY.

(Page 18, No. XV.)

The second of the three 1,030-ton torpedo vessels building at the Germania Works, at Kiel, was launched during the middle of November.

CHILE.

GUN TRIALS.

ESMERALDA.

(Page 21, No. XV.)

This 7,000-ton armored cruiser had successful trials of her guns December 16. Among other tests, one 8-inch and four 6-inch guns were simultaneously fired in the line of the keel, guns being laid level, both ahead and astern.

TORPEDO BOATS.

CAPTAIN MUNIZ GAMERO.

(Page 23, No. XV.)

Had her steam trials October 15; average revolutions and speed for six runs over the measured mile were 369 and 30.42 knots, and for the 3-hour trial 365 and 30.0 knots.

Launched.—The first of the six first-class boats building by Yarrow & Co. (p. 23, No. XV) was launched December 3.

TENIENTE SERRANO.

The third of the four first-class torpedo boats of the "destroyer" type, building by Messrs. Ladd, of Birkenhead, has had her speed trials, with the result of 30.34 knots on the measured mile, and 30.35 knots for the 3-hour continuous run following.

CHINA.

It is reported that China proposes to make an earnest endeavor to reconstruct her navy and assume rank as a naval power. The Bay of Kiau Chiau, on the south side of the Shantung promontory, is to be dredged out, fortified, and made a great naval port, and the arsenal at Fuchau is to be reörganized and enlarged so as to be capable of constructing all types of war vessels.

VESSELS PROPOSED.

In addition to the three protected cruisers to be built at the Vulcan Works, Stettin (p. 23, No. XV), the Armstrong Company has received an order to build two protected cruisers, of which the following are the principal data.

Dimensions.—Length over all, 424 feet; between perpendiculars, 396 feet; extreme breadth, 46 feet 8 inches; mean draught, 16 feet 9 inches; displacement, 4,300 tons.

Armament.—Two 8-inch R. F., mounted on middle line forward and aft, and each having a train of 135 degrees on either side of the middle line; ten 4.7-inch R. F. guns mounted in broadside, but the two forward and the two after guns train from directly ahead or astern to 45 degrees abaft the beam, and the others have a train of 60 degrees on either side of the beam; sixteen 3-pounders; six 1-pounders, and five torpedo tubes. The 1-pounders are mounted one in each upper fighting top and two in each lower top. One torpedo tube is placed in the bow and two on each broadside.

Machinery and boilers.—Twin screws driven by triple-expansion vertical engines designed to develop 17,000 I. H. P.; four double-ended and four single-ended boilers.

Protection.—Protective deck generally 1.5 inches thick, but 3 inches thick on slopes over machinery and 5 inches thick over cylinders. Conning tower 6 inches thick.

These vessels are to have a steaming radius of 2,100 knots at full speed and 8,000 knots at 10 knots per hour. They are to make 24 knots speed on forced draft, 22.5 knots on natural draft, to cost $1,638,351 each, and to be finished in 18 months.

TORPEDO BOATS.

Four first-class torpedo boats of the following characterics have been ordered from the Schichau Co., at Elbing: Displacement, 200 tons; 32 knots speed; price, $947,406 for the lot; time of construction, thirteen months.

FRANCE.

Two budgets for 1897 have been presented to the National Assembly by the minister of marine, the second after the withdrawal of the first one. The report of the committee charged to examine this latter (the first budget) was given in the name of M. J. de Kerjegu, and is a very interesting document. The total sum asked for was 258,082,273 francs ($49,809,878.68), of which 79,796,231 francs ($15,400,672.58) was for new construction, which is smaller than the amount for any year that has been voted since 1892; but at the same time it is stated in the report that a powerful, well-organized navy has never been more necessary to France than now.

The belligerent in the wars of the future, as well as in the wars of the past, that has at its disposal a naval force sufficient to make it impossible for the enemy's ships to keep the sea, possesses a considerable factor of success in the general war. Historical examples are cited to prove the influence of superior navies on the results of various wars, the latest instance of which is the efforts of the Cuban insurgents to achieve the independence of the island from Spain, for, the report says, without a sufficient navy Spain might have to give up her efforts to maintain her dominion over the island. Furthermore, the nations surrounding France have been making unremitting efforts for twenty-five years to build up powerful navies at the cost of the heaviest sacrifices, and it is shown that while the other naval powers of Europe have been increasing year by year for several years their appropriations for new construction, France has been giving less.

A comparison is made between the fleets of the possible enemies in the Mediterranean and north seas and her own Mediterranean and northern fleets, which are shown to be so separated geographically as to be out of supporting distance of each other, at least during the earlier stages of a war, and in which comparison the French fleets do not show up very well. Following this are tables showing the total tonnage armored and unarmored, under construction by the principal European nations on October 1, 1896. These give the triple alliance 150,000 tons, while France scarcely had 130,000; Russia has 115,000 tons, but England 355,000, and then the report makes a statement of considerable importance as showing the view of the committee as to the proper naval policy of France. It is given as follows:

> These comparisons suffice to demonstrate that we have not the fleet our policy requires, that which would permit us to sustain with advantage a contest with the triple alliance, and also to facilitate the regulation of difficulties that might be engendered between England and ourselves by the prolonging of certain misunderstandings or the clashing of our interests, so often in contact all over the world.

The report admits that it is out of the question to think of creating fleets as powerful as those of England, yet it is contrary to the genius of the French people to make only a passive defense, so a means is sought for carrying on an active vital warfare, and a saying of the great privateer Duguay-Trouin more than a hundred and fifty years ago is quoted as being as true to-day as then:

> If we have war with England instead of rousing ourselves to fight battles on the sea, which are infinitely costly to France, and where the English will oftenest have the superiority of numbers, it would be more useful for the service of the King and more ruinous to our enemies if we had forty or fifty vessels of from seventy-four to fifty guns in the port of Brest, that could be sent out in squadrons, following the advice that we would have of their enterprises and convoys, to chase and overtake them.

It is further stated that the war against commerce, the sole possible against England, would be equally efficacious against Germany, whose merchant-marine tonnage is more than 1,300,000.

Following, the committee state their opinion as to the character of the ship-building program France ought to undertake, viz: To get as many units as possible, reducing the tonnage of the ships in order not to exaggerate the financial sacrifices of the nation. They must be fast ships, but with speeds that survive the trials and that can be counted upon in service, and they must be ships with large radii of action. In order to create this fleet as quickly as possible, a financial effort is necessary. but the importance of it would be considerably lessened if reforms be not made in the administration of the navy. It is stated that this administration, and particularly that of the arsenals, has not kept pace with the advancement in matériel, and the charge is made that at the central administration there is an absence of cohesion between the directions which do not try sufficiently to keep up the entente necessary for unity of action. Moreover, six grand commissions in their multiplicity paralyze the authority of the commandment, relax the execution of orders, and disperse the responsibility of the decisions.

As stated above, after the withdrawal of this estimate, the minister of marine presented another, which has not yet been published.

VESSELS PROPOSED, AUTHORIZED, OR BUILDING.

HENRY IV.

(Page 45, No. XIII; 18, No. XIV; 28, No. XV.)

After many vicissitudes, which will be understood by comparing the above references with the following description, this vessel appears to have settled down with these principal details, viz: Modified monitor in form; dimensions, length, 354.3 feet; breadth, 72.8 feet; draught aft, 23 feet; displacement 8,807 tons; three screws, triple-expansion engines, designed to developed 11,500 I. H. P., which will give an estimated speed of 17 knots; armament, two 10.8-inch B. L. R., seven 5.45-inch R. F. guns, twelve 47-millimeter R. F. guns, and two under-water torpedo tubes; normal coal supply, 713 tons, full capacity, 1,083 tons; giving, respectively, 5,000 knots at 10 knots per hour and 1,120 at full speed, and 7,586 knots at 10 knots per hour and 1,700 at full speed; complement, 26 officers and 438 men.

D'ESTREES (EX K.).

Third-class cruiser, sheathed, building at Rochefort. The order for her construction was given July 29, 1896, and 1900 is the year fixed for completion. The following are the principal details:

Displacement, 2,413 tons; dimensions, length, 311.6 feet, breadth, 39.4 feet, draught aft, 17.7 feet; twin screws, triple-expansion engines, designed to develop 8,500 H. P., which will give an estimated speed of 20.5 knots.

Armament.—Two 5.45-inch R. F. guns, four 3.94-inch R. F. guns, and eight 3-pounders.

Normal coal supply, 340 tons; full capacity, 472 tons, giving radii of action, respectively, 5,750 knots at 10 knots per hour and 930 at full speed, and 8,000 knots at 10 knots per hour and 1,290 at full speed. Complement, 15 officers and 219 men. Estimated cost $910,711.

VESSELS LAUNCHED.

GAULOIS.

(Page 45, No. XIII; 29, No. XV.)

This 11,260-ton battleship, sister to the *Charlemagne* and *St. Louis*, was launched at Brest, October 6, exactly nine months after she was laid down. In this case an effort was made to establish a record. She was laid down on the same ways as the *Charlemagne*, the same plans and tracings were used, and considerable material was gathered in advance of the laying down. The *Charlemagne* was on the ways sixteen and a half months.

CATINAT.

(Page 47, No. XIII.)

This cruiser, a modified *Descartes* (p. 22, No. XIV), was launched from the yard of the Forges et Chantiers de la Méditerranée, at Havre, October 8. The principal details are as follows: Length, 332 feet; beam, 44.3 feet; draught aft, 21.2 feet; displacement, 4,000 tons; twin screws; triple-expansion vertical engines, designed to develop 9,000 I. H. P., giving a speed of 19 knots; steam furnished by Belleville boilers; complete protective deck, supplemented by cofferdams; four 6.46-inch R. F. guns, protected by 2.13-inch shields; ten 3.94-inch R. F. guns, with shields of same thicknes; ten 47-millimeter, four 37-millimeter, and two torpedo tubes. The ship is sheathed with one thickness of planking, and has a bunker capacity of 559 tons, giving an estimated radius of action of 6,000 knots at 10 knots speed, and 1,000 at maximum speed.

STEAM TRIALS.

CHARLES MARTEL, 11.900-TON BATTLESHIP.

(Page 9, Part I, No. XVI.)

Had a 6-hour coal-consumption trial September 30 at 5,000 I. H. P., and it was considered to be very satisfactory. Coal consumed was $3\frac{750}{2240}$ tons per hour; H. P., 5,382; speed, 13,806 knots The secondary battery of this vessel has been changed to some extent, and now consists of five 37-millimeter R. F. guns, fourteen 47-millimeter, and four 65-millimeter (9-pounders).

PASCAL, 3,988-TON CRUISER.

(Page 32, No. XV.)

This ship has had a 3-hour speed trial. Engines developed 7,232 I. H. P.; mean speed, 18.5 knots, coal consumption being 1.8 pounds per I. H. P. per hour.

VESSELS UNDERGOING MODIFICATIONS.

JEAN BART.

Military masts are to be replaced by simple schooner-rigged masts. The small guns formerly mounted in the fighting tops will now be placed on the bridges and spar deck.

FORMIDABLE.

In addition to receiving new boilers, her middle 14.6-inch gun is to be replaced by four 6.3-inch R. F. guns.

GUN TRIALS.

DRAGONNE.

(Page 117, No. IV.)

Experiments with mortar fire by this vessel have recently been made. The idea is not a new one in France, for there was laid down during the ministry of Admiral Aube, in 1886, a boat (the *Gabriel Charmes*) designed for the especial purpose. She was of 74 tons displacement and similar to a torpedo boat, but instead of a torpedo tube there was mounted a 5.5 B. L. R. about 26 feet from the bow, the boat being especially strengthened to withstand the shock of recoil. However, the experiments were not considered satisfactory and she was transformed into a regular torpedo boat. The *Dragonne* is of 320 tons displacement. A 6.1-inch mortar on coast carriage was mounted on board, and two series of firings have taken place. The first consisted of ten shots, five underway and five at rest, against an elevated shore battery at 5,200 meters (5,687 yards). All the shots struck within a square of 400 meters (437 yards) side; some swell was on at the time, the vessel making rolls of 10° on each side. The second series consisted of five shots underway and five at rest at each of the following ranges at an old hulk, the *Panama*, which had been filled with casks to prevent her from sinking (1,500 meters (1,674 yards), 1,000 meters (1,094 yards):

	Range.	Shots fired.	Hits.
	Meters.		
Anchored	1,500	5	1
Underway		5	1
Anchored	1,000	5	2
Underway		5	3
Anchored	500	5	4
Underway		5	3
Anchored	300	5	4
Underway		3	3
Total		38	21

The *Panama* filled and sank in spite of the casks. The firing began at 5 p. m., and most of it was done in a bad light and at the same time the vessel was rolling 20 degrees. This firing was considered so satisfactory that the experiments are to be continued, and it is reported shells carrying 17 kilos (37.4 pounds) of melenite are to be used.

TORPEDO BOATS BUILDING, ORDERED, OR PROPOSED.

DURANDAL AND HALLEBARDE.

First-class torpedo boats of the "destroyer" type, and the first of this type to be designed for the French navy, are to be built at the Normand yard. They have the following principal characteristics: Displacement, 300 tons; dimensions, length, 180.4 feet; breadth, 19.5 feet, draught of water aft, 10.5 feet; triple-expansion engines designed to indicate 4,800 H. P.; twin screws; Normand boilers; estimated speed, 26 knots; armament, one 65-millimeter (9-pounder) R. F. gun, six 47-millimeter R. F. guns, and two torpedo tubes. They will carry 44 tons of coal in bunkers, giving estimated radii of action of 2,500 knots at 10 knots speed, and 1,000 at maximum speed. Complements of 4 officers and 44 men. These boats are to cost $325,397 each.

CYCLONE (EX TENARE).

Seagoing torpedo boat, also building at the Normand yard, having the following characteristics: Displacement, 149.4 tons; dimensions, length, 147.6 feet; breadth, 15.2 feet; draught aft, 4.9 feet; twin screws, triple-expansion engines, Normand boilers, 3,300 I. H. P., giving estimated speed of 30 knots; armament, two 47-millimeter R. F. guns and two torpedo tubes; bunker capacity, 17 tons, giving estimated radii of action of 1,800 miles, at 10 knots, and 200 knots at maximum speed; cost, $180,358; complement, 2 officers and 32 men.

NOS. 201 AND 211.

Second-class boats of exactly similar characteristics, viz: Displacement, 82.7 tons; dimensions, length, 37 millimeters (121.3 feet); breadth, 13.3 feet; draught aft, 8.5 feet; single screws, triple-expansion engines, Normand boilers, 1,500 I. H. P.; estimated speed, 23.5 knots; armament, two 37-millimeter R. F. guns and two torpedo tubes; bunker capacity, 10.5 tons, giving estimated radii of action of 1,800 knots at 10 knots speed and 200 at maximum speed; complement, 2 officers and 21 men; cost, *No. 201*, $86,842; *Nos. 202* to *205*, $88,007; *Nos. 206* to *211*, $74,983. *Nos. 201* to *205* are building at the Normand yard, and *Nos. 206* to *211* at the yard of the Société de la Gironde at Bordeaux. A noteworthy fact in regard to all of the torpedo boats above described is that they are of the Normand type and have Normand boilers.

STEAM TRIALS.

MANGINI.

This first-class boat had forced-draft trials at Lorient during October and obtained a speed of 27 knots, being 2 knots in excess of estimated speed. This boat has the following principal characteristics: Displacement, 127 tons; dimensions, length 147.6 feet, breadth 14.75 feet; draught aft, 6.9 feet; twin screws; triple-expansion engines of 2,100 I. H. P.; Du Temple boilers; armament, two 47-millimeter R. F. guns and two torpedo tubes; bunker capacity, 18 tons, giving estimated radius of action of 1,800 knots at 10 knots speed and 200 at maximum speed.

CASUALTIES.

Torpedo boats *Nos. 61* and *83*, while exercising off Brest November 19, came into collision, both going at about 12 knots speed. The bow of *No. 61* struck *No. 83* on the starboard side abreast of the boilers, and the latter sank in just three minutes, one man being drowned and three injured. *No. 83* is one of a type of fifty (*Nos. 75* to *125*), 35 meters (114.8′), designed in 1885, that has been very unfortunate. March 21, 1889, *No. 110* foundered with all hands in a heavy sea while making passage from Brest to Cherbourg, and March 1, same year, *No. 102* capsized off Toulon with considerable loss of life while in company with five other boats. After these accidents the class underwent modifications, so that there is not much fear of their stability, but they seem to lack in strength of hull. On the contrary, *No. 61* is one of a type of 33-meter (108.2′) boats built about 1880 by Normand. Boats of this type have done good service and are still considered to be good and reliable boats.

GERMANY.

By reason of the success of some recent trials, an order has been issued that in new construction designed to carry guns of these sizes the 24-centimeter (9.45 inches), 21-centimeter (8.27 inches), 15-centimeter (5.9 inches) Krupp R. F. L/40 shall be installed. It is claimed that these guns mark a great advance in naval ordnance, and their installation on board of German ships gives the latter considerable superiority over similar foreign vessels. This order will affect the following ships under construction: *Kaiser Friedrich III* (p. 41, No. XV), *Ersatz Friedrich der Grosse*, sister to above, *Ersatz Leipzig*, cruisers *K. L. Ersatz Freya*, and *M.* and *N.* (p. 42, No. XV).

VESSELS BUILDING, ORDERED, OR PROPOSED.

The navy department has asked for appropriations for the following new vessels: *Ersatz König Wilhelm* (to be of same type as *Kaiser Friedrich III*). Second-class cruisers *O* and *P*, *Ersatz Falke*, *Ersatz Hyane*, *Ersatz Iltis*, one torpedo division boat and eight torpedo boats, but as yet the Reichstag has not voted them. Appropriation was also asked for new machinery, new boilers, and thorough overhaul of the four second-class battleships of the *Sachsen* class. The changes on the *Baden* and the *Bayern* of this class are nearly completed.

VESSELS STRUCK FROM LIST.

The battleships *Preussen* and *Friedrich der Grosse* have been stricken from the list of seagoing vessels and relegated to duty as harbor ships.

GREAT BRITAIN.

VESSELS AUTHORIZED OR BUILDING.

FOUR FIRST-CLASS CRUISERS.

(Page 51, No. XV.)

These have received the names *Argonaut*, to be built by J. & G. Thomson, Clydebank; *Ariadne*, by the Fairfield Company, Glasgow; *Amphitrite*, by the Naval Construction and Armaments Company, Barrow-in-Furness, and *Spartiate*, to be built at Pembroke dockyard. These vessels are in general similar to the four of the *Diadem* class (p. 35, No. XIV), but there are slight differences in the details. Their principal characteristics are: Length between perpendiculars, 435 feet; breadth, 69 feet; mean draught, 25.25 feet; displacement on this draught, 11,000 tons; twin screws; four cylinder triple-expansion engines, designed to develop 18,000 H. P. when working at 120 revolutions, and giving an estimated speed of 20.75 knots; 30 Belleville boilers with total heating surface of 47,850 square feet, and grate surface, 1,390 square feet, making steam at working pressure of 300 pounds per square inch; complete protective deck having a rise of 10 feet, and varying in thickness from 4 inches on slopes to 2.5 on crown; coal bunks above and below protective deck; armament—sixteen 6-inch R. F. guns, twelve 12-pounders, three 3-pounders, eight Maxims, and three torpedo tubes, of which two are below water and one above, located at the stern. These vessels are to be sheathed with teak.

IMPROVED TALBOTS.

(Page 51, No. XV.)

The three cruisers of this type have received the names *Hyacinth*, *Highflyer*, and *Hermes*, and are to be built, the first two by the Fairfield Company, Glasgow, and the last by the London and Glasgow Shipbuilding Company. They are similar to the *Talbot*, but larger, and are designed to carry more coal, be somewhat faster, and have a heavier armament. They are to be 360 feet long, 54 feet breadth, 6,000 tons displacement, to be fitted with Belleville boilers of 10,000 H. P., and to make about 20 knots.

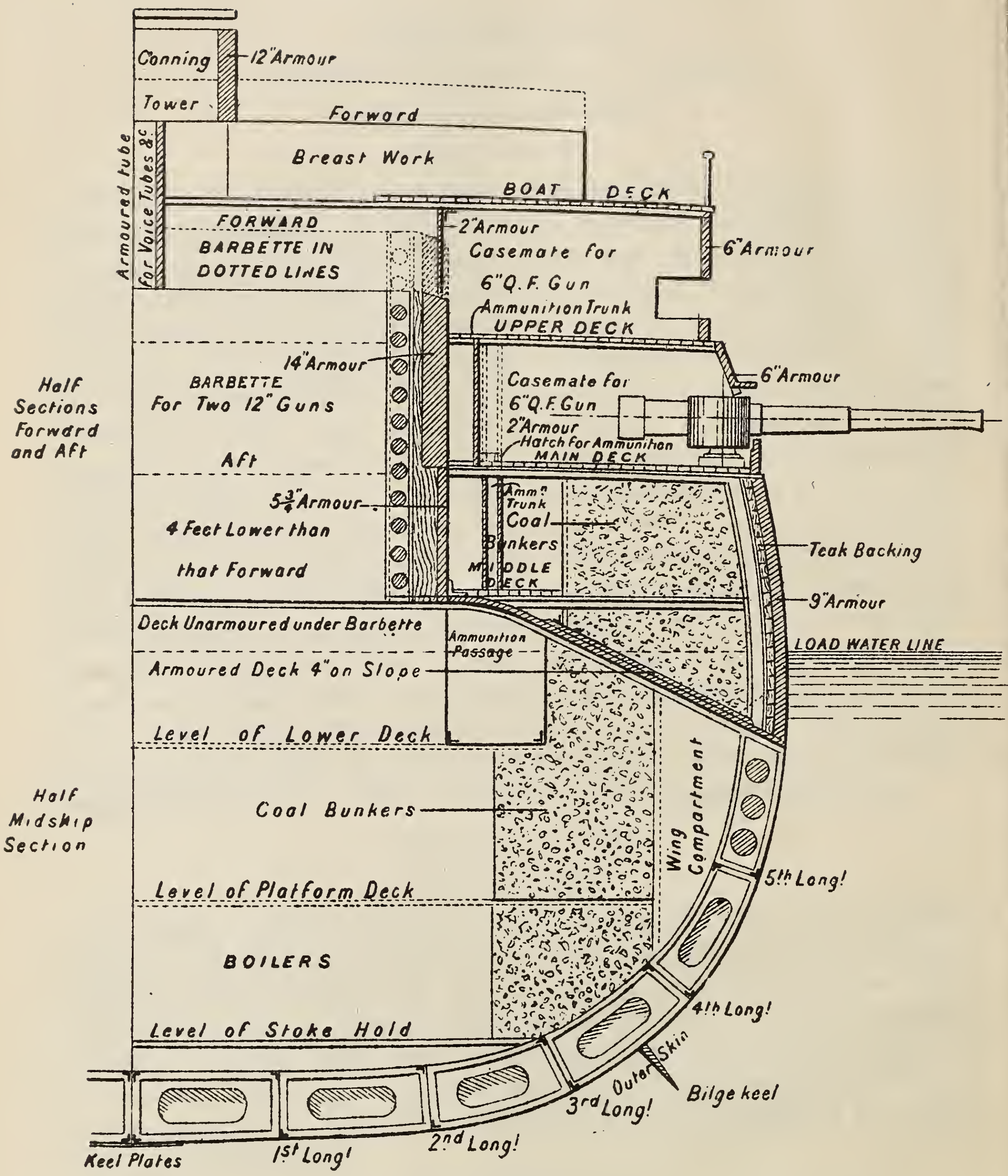
GLORY.

(Page 9, Part I, No. XVI.)

The keel of this first-class battleship was laid December 1, 1896.

VESSELS LAUNCHED.

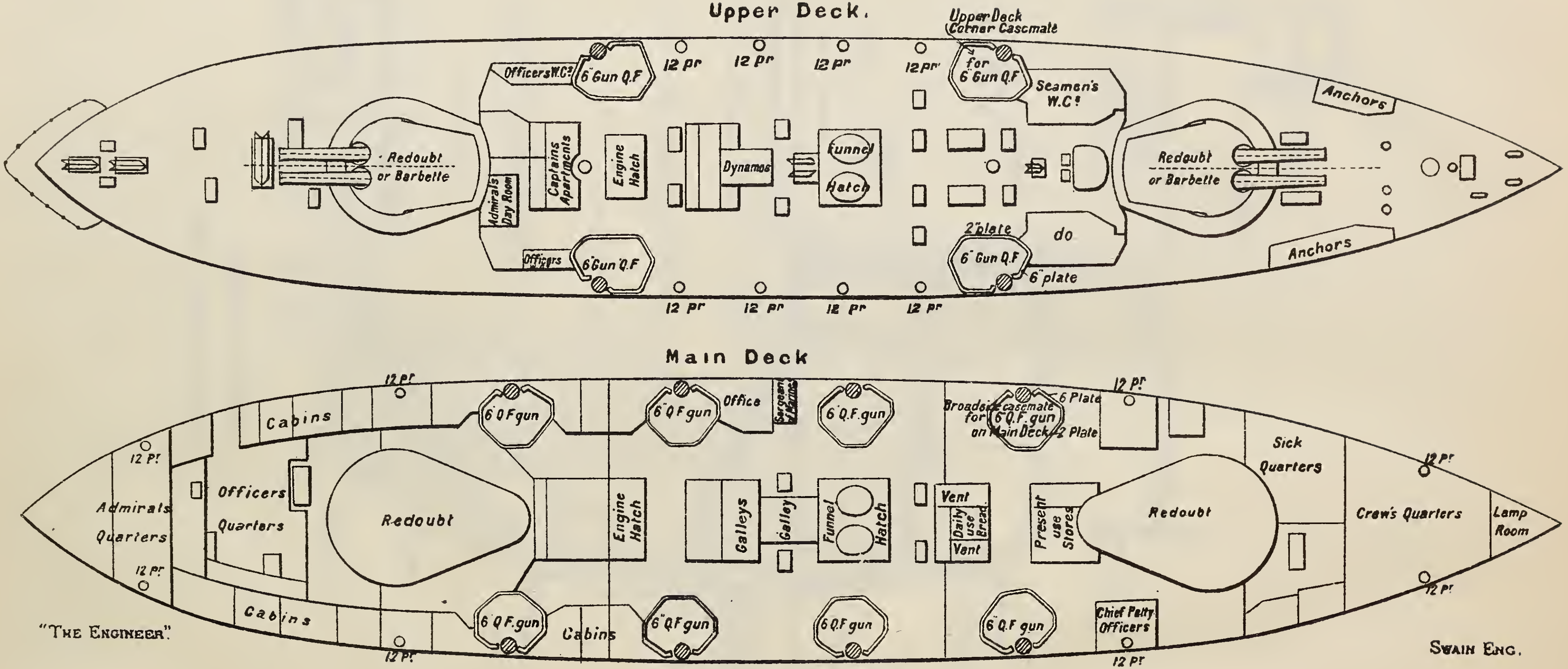
Diadem, first-class cruiser (British classification), 11,000 tons (p. 35, No. XIV), October 20. *Furious*, second-class cruiser (British classification), 5,750 tons (p. 35, No. XIV), December 3. *Gladiator*, second-



COMBINED SECTION

H.M.S. PRINCE GEORGE

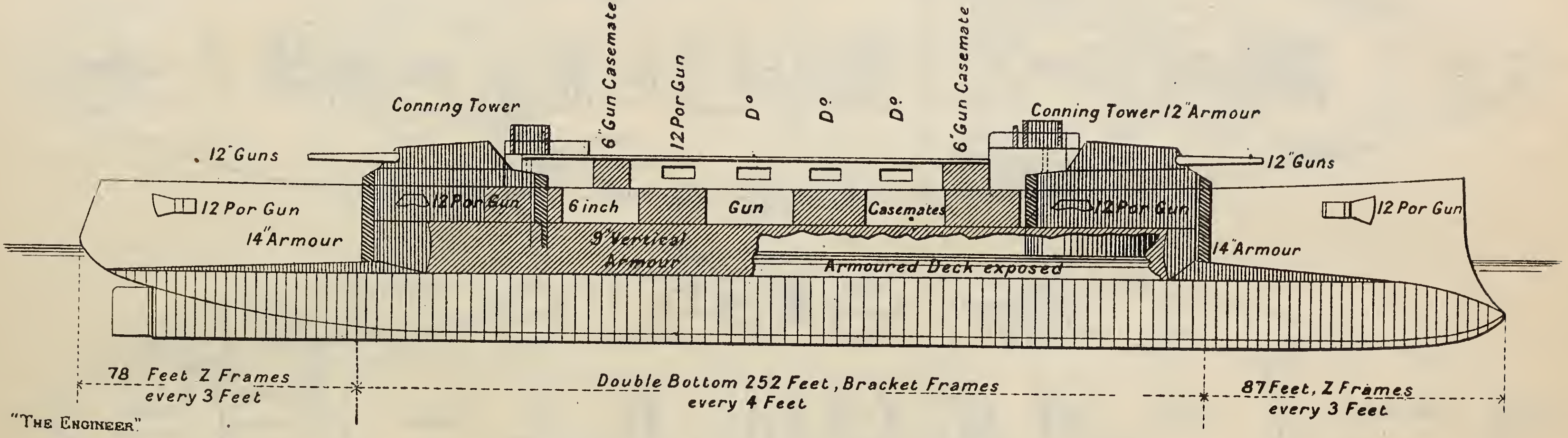
"The Engineer"



H.M.S. PRINCE GEORGE

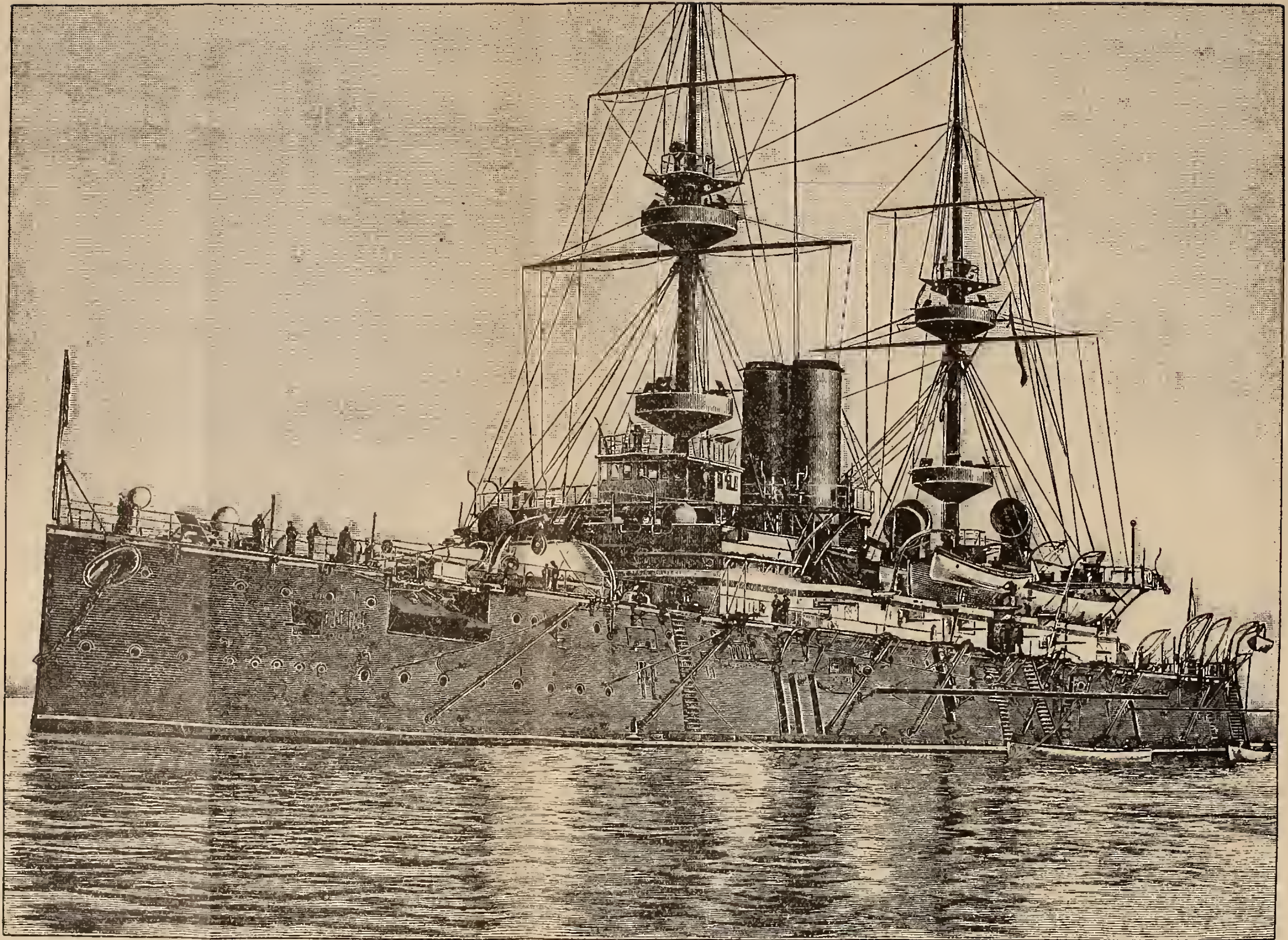
"The Engineer."

Swain Eng.



"THE ENGINEER."

H.M.S. PRINCE GEORGE—DISPOSITION OF ARMOUR



"PRINCE GEORGE."

class cruiser (British classification), 5,750 tons (p. 35, No. XIV), December 8. *Proserpine*, third-class, cruiser (British classification), 2,135 tons (p. 36, No. XIV; 53, No. XV), December 5.

STEAM TRIALS.

AMPHION.

After extensive refit has undergone a 4-hour trial, during which the engines developed 5,105 I. H. P., and a speed of about 16 knots was obtained. Three previous trials proved unsuccessful.

DIANA, DORIS, JUNO, MINERVA, AND VENUS, 5,600-TON PROTECTED CRUISERS.

(Page 52, No. XV.)

Name.	Trial.	I. H. P.	Speed.	Consumption.
			Knots.	*Pounds.*
Diana	Forced draft, 4 hours	9,875	20.6	....
	Natural draft, 8 hours	8,252	19.72	[a]2.25
	Coal consumption, 30 hours	4,916	17.24	1.47
Doris	Forced draft, 4 hours	9,851	20.1	....
	Natural draft, 8 hours	8,392	19.1	....
	Coal consumption, 30 hours	....	....	....
Juno	Forced draft, 4 hours	9,771	20.75	....
	Natural draft, 8 hours	8,273	18.9	....
	Coal consumption, 30 hours	4,863	16.3	1.64
Minerva	Forced draft, 4 hours	9,891	20.34	....
	Natural draft, 8 hours	8,221	19.6	....
	Coal consumption, 30 hours	4,919	17.52	1.7
Venus	Forced draft, 4 hours	9,774	20.18	....
	Natural draft, 8 hours	8,204	19.25	....
	Coal consumption, 30 hours	4,876	16.8	1.6

[a] Per I. H. P.

MAJESTIC.

(Page 53, No. XV.)

This first-class battleship has recently undergone a progressive series of trials to determine if the speeds given on the official steam trials are illusory or not. The first series consisted of five runs over the measured-mile course in Stokes Bay, with following results:

Run.	Mean revolutions.	Total I. H. P.	Speed.
			Knots.
First	24.51	223.04	4.103
Second	60.40	2,224.27	10.357
Third	74.62	4,116.20	12.547
Fourth	85.80	7,010.48	14.305
Fifth (full natural draft)	98.18	10,082.90	16.096

Second series consisted of runs under forced draft over a 23-mile course, giving results as follows:

Run.	Air pressure.	Mean revolutions.	Total I. H. P.	Speed.
	Inches.			*Knots.*
First	1	103.10	11,814	16.86
Second	1.08	102.45	11,914	16.90
Third	1.17	103.40	11,673	16.80
Mean	1.08	102.98	11,800	16.85

These results are considered to be satisfactory, since on her natural-draft trials September, 1895, she made but 16.9 knots by patent log, with engines developing 10,418 I. H. P., and on forced draft the speed was then 17.9 and I. H. P. 12,497.

PELORUS, 2,135-TON CRUISER.

(Page 53, No. XV.)

This vessel had her trials during the first week of November, of which the following are the principal data:

Trial.	Pressure in boilers.	Mean revolutions.	Mean total I. H. P.	Speed. *a*
	Pounds.			*Knots.*
Forced draft, 4 hours	260	217	7,028	20.73
Natural draft, 8 hours	250	189	5,249	19
Coal consumption, 30 hours	248	162	3,567	16.25

a Patent log.

POWERFUL.

(Pages 15, No. XIII; 39, No. XIV.)

This vessel has recently undergone a series of exhaustive and severe steaming trials, principally for the purpose of determining the efficiency of her installation of Belleville water-tube boilers, of which she has 48. These trials are very interesting from a professional point of view, not only because this is the first large vessel of the British navy fitted with water-tube boilers that has been tried, but because of the character of the ship herself and the purpose for which she was designed. As has been stated, her boiler installation consists of 48 Belleville boilers. These are designed for a working pressure of 260 pounds per square inch, have a total heating surface of 69,453 square feet, and a total grate area of 2,192 square feet. They take up 186 feet of the length of the vessel, which is divided into eight water-tight compartments by one longitudinal and five thwartship bulkheads. The boilers are arranged to be fired fore and aft.

The program of trials consisted of a run of thirty hours at 5,000 I. H. P.; one of thirty hours at 18,000 I. H. P.; last, a run of eight hours, of which the first half was at 25,000 I. H. P. and the second half at 22,000 I. H. P. The first two runs were for the purpose of determining the coal consumption at the powers developed. A start for the first trial was made on September 25, but after running ten hours it was decided to return to Spithead on account of a severe storm which had sprung up. Although this was a failure as far as desired results were concerned, yet it proved the seaworthiness and steadiness of the ship in a seaway. September 28 the 5,000-H. P. trial commenced, and terminated on the 29th successfully. The 18,000-H. P. trial was made on the 13th and 14th of October, and on November 27 the final trial took place. The following table gives the principal data of these trials:

Trial.	Draught.		Boiler pressure.	Vacuum.		Revolutions.		
	Forward.	Aft.		Starboard.	Port.	Starboard.	Port.	Mean.
	Ft. In.	*Ft. In.*	*Pounds.*	*Inches.*	*Inches.*			
5,000 I. H. P. (30 hours)	27 3	27 2	225	26.8	27	67.4	67	67.2
18,000 I. H. P. (30 hours)	27 5	27 6	232	26.7	26.5	103.62	101.98	102.8
25,000 I. H. P. (4 hours)	26 3	28 1	257	26.2	25.9	115	113.8	114.4
22,000 I. H. P. (4 hours)	26 3	28 1	237.5	26.2	26	109.6	109.5	109.55

Trial.	I. H. P.			Mean speed.	Coal per I. H. P. per hour.
	Starboard.	Port.	Total.		
				Knots.	*Pounds.*
5,000 I. H. P. (30 hours)	2,455	2,553	5,008	14	2.07
18,000 I. H. P. (30 hours)	9,188	9,245	18,433	20.8	1.838
25,000 I. H. P. (4 hours)	12,665	13,231	25,886	21.8	(*a*)
22,000 I. H. P. (4 hours)	10,955	11,679	22,634	(*a*)	(*a*)

(*a*) Not taken.

Although the speed fell short of the estimated 22 knots, these trials are considered to be an unqualified success as far as the boilers are concerned and completely vindicate the admiralty in their determination to make such a radical change in the character of the boilers installed in the large ships. In the interval between the 18,000-H. P. and the 25,000-H. P. trials, the smoke pipes had been lengthened 10 feet, and the change proved advantageous. It is interesting to note that during all of these trials the maximum temperature recorded in the engine rooms was 75 degrees, and in the fire rooms the temperature never exceeded 90 degrees. The importance of these figures is obvious.

VESSELS REFITTING.

AUDACIOUS.

To have a thorough overhaul and repair, including new boilers and the substitution of heavy R. F. guns for her present armament.

AURORA.

To receive a new battery of modern guns and to have smoke pipes lengthened 16 feet.

LEANDER.

Undergoing extensive repair at Chatham. Ten 6-inch R. F. guns are to be substituted for her 6-inch B. L. R., and 3-pounders will be substituted for the Nordenfelts; in addition to which the ship is also rceeiving extensive repair.

MERCURY.

To have a complete refit, including modern R. F. guns. Estimated cost, $104,619.

TORPEDO BOATS.

LAUNCHES.

The launches of the following first-class torpedo boats (destroyers) have been noted: *Brazon*, *Chamois*, *Earnest*, *Crane*, *Electra*, *Foam*, *Griffon*, *Locust*, *Mallard*, *Recruit*, *Star*, and *Whiting*.

STEAM TRIALS.

The following first-class torpedo boats (destroyers) have been tried, with results as shown, these results being the mean of six runs over a measured mile: *Desperate*, 30.43 knots; *Quail*, 30.38; *Sparrowhawk*, 30.56; *Salmon*, 27.88; *Snapper*, 27.91; *Swordfish*, 27.12; *Thrasher*, 30.36; *Virago*, 30.57. These results were not obtained on first trial in every case.

ITALY.

The budget presented by the minister of marine for fiscal year July 1, 1897, to June 30, 1898, calls for a total appropriation of $19,536,356, of which $3,667,000 is for construction. In this latter sum is included provision for continuing the construction of the *Ammiraglio di Saint Bon*, *Emanuele Filiberto*, *Puglia*, *Agordat*, *Coatit*, *Carlo Alberto*, *Vettor Pisani*, *Giuseppe Garibaldi*, and the *Varese*, for the construction of torpedo boats of the "destroyer" type, and for first-class torpedo boats.

JAPAN.

It is reported that an order has been placed with the Thames Iron Works and Shipbuilding Company for a battleship of 14,500 tons displacement, and also that the Japanese Government has ordered an armor-clad at the Vulcan Works, Stettin, and several torpedo boats from Schichau, at Elbing. December 31, 1896, a contract was signed in Washington, D. C., by the representatives of the Japanese Government and Messrs. Cramp and the representatives of the Union Iron Works of San Francisco for the construction by each of these firms of a cruiser of probably the following characteristics:

Length	feet..	374.5
Breadth	do...	48.75
Mean draught	do...	17.75
Displacement	tons..	4,760

Armament.—Two 8-inch guns on center line, one forward and one aft; twelve 4.7-inch in broadside, twelve 12-pounders, six 1-pounders, and five torpedo tubes.

They will have no armor on the side, but will have an armored deck of a maximum thickness of 6 inches. The contract calls for a forced draft speed of 22.5 knots, and they are to be delivered by the end of two years.

NANIWA.

The changes in battery mentioned on page 72, No. XV, have been made. Six-inch Armstrong R. F. guns of 35 calibers have been substituted for the 5.9-inch B. L. R. Cordite is supplied for these guns, the charge being 36 pounds, giving an I. V. of 2,200 feet. There are 120 rounds of ammunition for each gun. Sixteen shells for each gun are kept on deck, but no powder.

NETHERLANDS.

A program of reorganization of the navy has recently been published. Twelve protected cruisers of the *Holland* class (p. 51, No. XIV), modified; six armored vessels of the *Kortenaer* class (p. 59, No. XIII), modified; three coast-defense monitors of about the same type as the *Reinier Claessen* (p. 58, No. X); three coast-defense monitors of a type smaller than this; fifteen gunboats; fifteen 30-knot torpedo boats, and ten 18 to 20 knot torpedo boats are proposed. The principal data of the armored ships are as follows:

Length over all	feet..	287
Extreme breadth	do...	49.9
Draught	do...	17.7
Displacement	tons..	3,936
I. H. P		5,300
Speed	knots..	16
Coal capacity	tons..	250

Their armament will consist of two 9.45-inch 40-caliber guns in hooded barbettes, one forward and one aft on the center line, the barbettes being 9.8 inches thick; four 4.7-inch 40-caliber R. F. guns; six 2.95-inch 40-caliber R. F. guns, and eight 37-millimeter.

The principal data of the larger type of monitor are:

Length over all	feet..	198.8
Breadth	do...	43.3
Draught	do...	10.17
Displacement	tons..	1,700
I. H. P		700
Speed	knots..	9.5
Coal capacity	tons..	60

Armament.—Two 8.37-inch 40-caliber guns, one forward and one aft, in barbettes of 7.87-inch thickness, with shields of 5.9-inch thickness; four 2.95-inch R. F. guns, and four 37-millimeter. Protective deck of 2-inch thickness.

The smaller type are to have the same dimensions as the other, except their draught will be 11.4 feet; displacement 1,406 tons. They will have only one 8.27-inch gun, which will be located forward; and aft, in place of the 8.27-inch gun, there will be a 4.7-inch gun, the other guns of the armament being the same as for the large type. Protective deck the same.

VESSELS LAUNCHED.

MATARAM.

This gunboat, of 810 tons, for colonial service, sister to *Nias* (p. 74, No. XV), has recently been launched.

RUSSIA.

VESSELS PROPOSED.

It is proposed to build the following vessels: An armored cruiser of 14,000 tons displacement, of the *Russia* type (p. 54, No. XIV), at the Baltic works. This vessel is mentioned on page 77, No. XV, as being a battleship; an Armored coast-defense vessel of the *General Admiral Apraxin* type, 4,126 tons (p. 55. No. XIV), at the new admiralty yard at St. Petersburg; a battleship of the *Sessoi Veliki* type, 8,800 tons (p. 67, No. XIII), but to be of 11,500 to 12,000 tons displacement, to be laid down at Nicolaef; a third cruiser, of the *Diana* class, 6,630 tons (p. 78, No. XV).

VESSELS LAUNCHED.

ROSTISLAV, 8,880 TONS.

(Page 77, No. XV.)

This battleship was launched at Nicolaef September 2.

SVETLANA, 3,828 TONS.

(Page 78, No. XV.)

This cruiser was launched December 4 from the works of the Forges et Chantiers, at Havre.

STEAM TRIALS.

TRI SVIATITELIA, 10,600 TONS.

(Page 68, No. XIII.)

This battleship has had a successful twelve hours' full-speed trial. Considerably more than the contract I. H. P. was developed, and a speed of 18 knots was obtained, 2 in excess of that for which the vessel was designed.

STANDART, 5,200 TONS.

(Page 58, No. XV.)

This imperial yacht has obtained, on forced-draft trial, a speed of 21.18 knots, with 10,600 I. H. P.

CHANGE IN ARMAMENT.

NAVARIN, 9,500 TONS.

(Page 38, No. IX.)

This battleship has had her secondary armament changed so that it now consists wholly or in part of eighteen 3-pounders and ten 1-pounders.

GROUNDING OF THE RUSSIA.

(Page 54, No. XIV; 80, No. XV.)

The 12,130-ton armored cruiser *Russia*, while proceeding from St. Petersburg to Cronstadt in the latter part of October, went aground in Cronstadt Roads. At the time a westerly gale was blowing, and the water had banked up so that it was much higher than usual; but soon after the vessel grounded the wind died out and the water began to fall, leaving her hard and fast. Great exertions have been made to get her afloat, because of the danger of her remaining in the position in which she is during the winter months, when the harbor freezes over; but it appears that these efforts have been unsuccessful, although a recent report states that she has been floated.

TORPEDO BOATS.

PROPOSED.

Three first-class torpedo boats of the *Sokol* type (240 tons, 29 knots; p. 59, No. XIV; 83, No. XV) are to be constructed at the Vulcan Dockyard at Kalpino (Ijora Works), and two, perhaps four, first-class boats of the *Pernov* type, 118 tons, will probably be built at Nicolaef.

LIQUID FUEL.

Extensive experiments in the burning of petroleum fuel in torpedo boats have been made, and the success of these has been sufficiently marked to decide the Russian admiralty to use petroleum extensively, if not entirely, in their torpedo boats, and perhaps to some extent in their coast-defense vessels.

TRANSPORTATION BY RAIL.

Recently a torpedo boat was transported by rail from St. Petersburg to Sebastopol successfully, and it is now contemplated to send several more by the same route to strengthen the Black Sea fleet.

SPAIN.

The Spanish Government is bringing forward its ships as rapidly as possible. This is particularly noticeable in the *Cristobal Colon*, building at Genoa, upon which the work is being carried on night and day, 1,500 men being employed. Her boilers are to be of the Niclausse type. Spanish subjects residing abroad continue to contribute for making additions to the navy, and the Spanish colony at Buenos Ayres alone has contributed $400,000 for building a vessel, the plans of which have not yet been determined upon. The admiralty has had under consideration bids for the construction of a 11,000-ton battleship and a 6,500-ton cruiser, but as yet it does not appear that contracts have been made for these. As soon as the 6,500-ton cruiser has been decided upon, plans will be made by the Spanish constructors and the construction of a duplicate will be undertaken at Cadiz.

VESSELS LAUNCHED.

DONA MARIA DE MOLINA, 823 TONS.

(Page 86, No. XV.)

This torpedo vessel was launched at Ferrol, October 8, 1896.

PRINCESA DE ASTURIAS, 7,000 TONS.

(Page 85, No. XV.)

This armored cruiser, whose unsuccessful attempt at launching was mentioned on page 14 of Part I, No. XVI, has finally gotten into the water. After a month in her original position, having defied all efforts to complete the launch, she quietly slid into the water on the afternoon of the 17th of October, at high tide, apparently little the worse for her experience.

SHIPS REFITTING AND RE-ARMING.

PELAYO, 9,900 TONS.

(Page 207, No. V; 356, No. VIII.)

This battleship arrived at Toulon on November 29 for refit and rearmament. The work is to be done at La Seyne. She is to receive new boilers of the Niclausse system and a new battery of 5.5-inch Canet R. F. G. in place of the 4.7-inch B. L. R. Her heavy guns will remain as now installed, namely, two 12.6-inch 49-ton Hontoria B. L. R. in barbettes, one forward and one aft on center line of ship, and two 11-inch 33-ton Hontoria B. L. R. in barbettes, one on each side in the waist. There will be nine 5.5-inch R. F. G., of which eight will be mounted in broadside and one in the bow, replacing the present twelve 4.7-inch guns in broadside and the one 6.3-inch gun in the bow. The work of removing the boilers and guns has not yet begun, and it is estimated that when it has been seriously undertaken the ship will not be ready for service for perhaps a year. One hundred and fifty thousand five hundred and forty dollars has been appropriated for the new battery and ammunition and $289,500 for the new boilers and work on the hull.

On December 22 the statement was made in a ministerial newspaper that the extensive repairs to the *Pelayo* had been indefinitely postponed, because the time required to make them would be eight mouths, and that the most urgent small repairs to her present machinery, boilers, and battery would be hurriedly made, so that the ship could be available for service by the middle of February, 1897.

NUMANCIA.

This old ironclad is to be thoroughly renovated at La Seyne and made as completely modern as possible. The present armor of the ship is to be kept, but new boilers will be put in; the engines are to be overhauled and new battery installed. The new battery will probably be composed of four 6.3-inch Hontoria B. L. R., eight 5.5-inch Canet R. F. G., three 4.7-inch R. F. G., and smaller R. F. and machine guns. This ship is briefly described as follows: An old-style broadside ironclad, launched in 1863; length on load-water line, 314.9 feet; extreme breadth, 58.66 feet; displacement, 7,305 tons on a mean draught of 25.75 feet. She has a complete belt of iron armor 5.12 inches thick extending from 7.5 feet below water line up to spar-deck beams, with a wood backing 11 inches thick. Her total coal capacity is 1,370 tons; capacity at load-water line, 1,100 tons. Her original speed was 10 knots.

VITORIA.

This vessel is at La Seyne to receive complete renovation and to be brought up to date as nearly as possible. The work to be done is of the same character as that on the *Numancia*, above described, and it may be noted that in both of these cases it is urgently required that the work be hastened with all possible speed. The new battery will probably be composed of six 6.3-inch Hontoria B. L. R., six 5.5-inch Canet R. F. G., and six 4.7-inch Canet R. F. G., with smaller R. F. and machine guns. The *Vitoria* is an old broadside ironclad, launched in 1865, having a complete belt of iron armor 5.51 inches thick extending from 8 feet below the water line to the spar-deck beams. In addition, this armor is carried up just abaft the smoke pipes, so as to form a small redoubt for one gun on each side of the spar deck. The armor is backed by 14 inches of wood. She is 318.2 feet long on load-water line, 55.66 feet extreme breadth, with a displacement of 7,250 tons on a mean draught of 24.4 feet. She has a normal coal capacity of 885 tons, and originally had a speed of 11 knots.

TORPEDO VESSELS.

An order has been placed with Messrs. J. & G. Thomson, Clydebank, for the construction of two more torpedo vessels of the *Furor* type (p. 86, No. XV) modified, to be named the *Pluton* and *Proserpina*. This class is of the "destroyer" type of torpedo boat, but of larger displacement and heavier armament. When this last order is filled Messrs. J. & G. Thomson will have constructed six of these vessels for the Spanish Government, namely, the *Furor*, *Terror*, *Odaz*, *Osado*, and the two named above.

FUROR AND TERROR.

The torpedo-boat destroyers *Furor* and *Terror* were designed and built by Messrs. James & George Thomson, Limited, Clydebank, to the order of the Spanish Government. They have now completed their trials and have arrived in Spain. Although similar in general design to the "destroyers" of the British navy, there are several departures in detail and the vessels are in some respects more nearly akin to the torpedo gunboats. For example, they are fitted with teak upper decks in addition to a complete steel deck; double awnings for the whole length of the vessel, with side curtains hanging to the water's edge, electric lighting throughout, and a number of electrical ventilating fans for insuring a supply of fresh air to the officers' and crew's quarters; so that the vessels will be much more habitable than an ordinary torpedo-boat destroyer when serving in the tropical or semi-tropical climates for which they are intended. The contract provided that the mean speed should be determined by four runs on the measured mile and by a further trial of two hours' duration, during which the speed should not be less than 28 knots. It was further stipulated that a load of 75 tons should be carried on trials, which is more than twice the load required in the case of vessels of a similar type built for the British navy.

The vessels have a length of 220 feet, breadth 22 feet, and have a molded depth of 13 feet. The load displacement is 380 tons. The armament consists of two 14-pounder R. F. G., the one mounted forward on top of the conning tower and the other aft; two 6-pounder guns of the same type mounted on the broadside, and two 37-millimeter automatic R. F. G., one on the starboard and the other on the port bow. All these guns have been supplied by the Maxim-Nordenfeldt Guns and Ammunition Company, Limited, and are of the latest and most improved pattern. Their position in the ship is shown by the deck plans. The vessels are also equipped with two torpedo tubes, 14 inches in diameter, mounted on the upper deck, so as to fire off either side of the ship. The torpedo tubes are on the Schwartzkopff system. Four torpedoes are carried, and there is, of course, a complete installation of air-compressing machinery for charging them, the engines and pumps being in the engine room.

After some preliminary trials the *Furor* successfully passed her official forced draft trial on October 30. The mean speed of four runs on the measured mile exceeded the contract by about a quarter of a knot, and the revolutions were maintained without difficulty for the two hours' trial. The *Terror*, after a single preliminary trial, completed her natural-draft trial, and at the next succeeding trial successfully completed her official forced-draft trial. The natural-draft trials were of the same duration as the forced-draft trials, and it was provided by the contract that a speed of 21½ knots be maintained with the air pressure in the stokeholds not exceeding three-fourths of an inch of water.

THE SPANISH TORPEDO-BOAT DESTROYERS "FUROR" AND "TERROR."

CONSTRUCTED BY MESSRS. JAMES AND GEORGE THOMSON, LIMITED, CLYDEBANK.

Fig 2

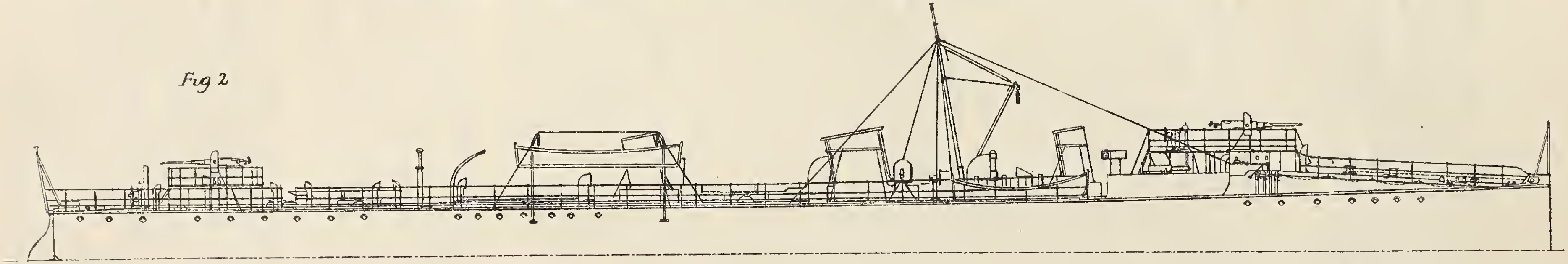


Fig 3. Upper Deck

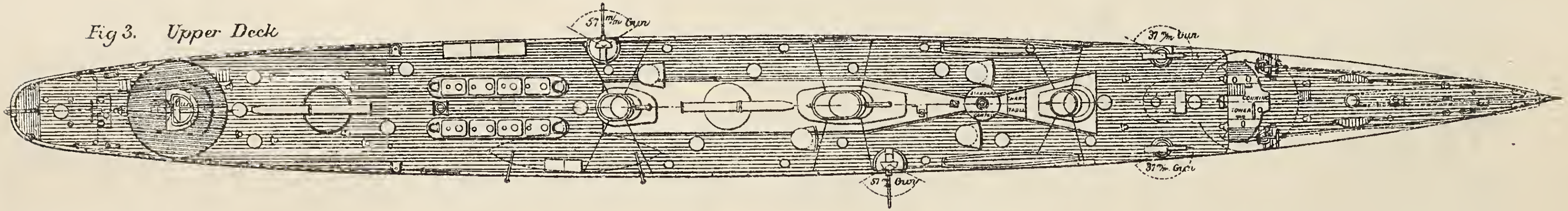
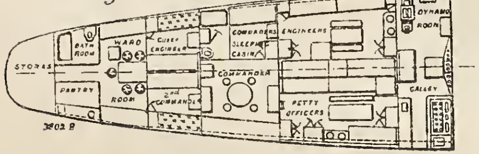
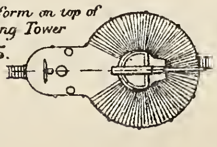
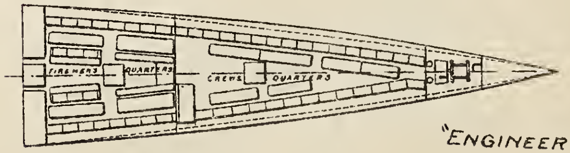


Fig.4. Lower Deck



Gun Platform on top of Conning Tower
Fig.5.





"ENGINEERING"

It was found that this speed could be maintained with very great ease; indeed, the stipulated speed was exceeded by about a knot.

After the speed trials, the firing trials of the guns were carried out to the entire satisfaction of the inspecting officers. The terribly destructive nature of the fire, especially from the automatic guns, was very apparent, a perfect hail of projectiles of 37 millimeters, or about 1½ inches, in diameter being delivered by these guns, and continued so long as the person firing the gun kept his finger pressed on the trigger, the whole of the operations of loading and firing being automatically performed by the energy of the recoil.

The vessels are fitted with steam steering gear of the type usual in torpedo-boat destroyers. The engine, which is of the vertical pattern, bolted to the after bulkhead in the engine room, was supplied by Messrs. Caldwell & Co., Limited, of Glasgow. The steam capstan gear is driven by a horizontal 2-cylinder engine, supplied by Messrs. Napier Brothers, Limited, also of Glasgow.

The vessels are propelled by twin screws, each propeller being driven by an independent set of 4-cylinder triple-expansion engines situated in one compartment aft of the boiler rooms. Steam is supplied by four boilers of an improved Normand type, placed in two water-tight compartments. These are fired from two stokeholds, the furnaces of the forward and aft boilers discharging into separate funnels, while those of the two center boilers lead up to a common central funnel of larger size. The cylinders, which are entirely independent castings, are bolted together, and are stayed transversely between each other, and also to gusset plates in the wings, connecting the deck beams and the frames. A pair of struts extend from each of the high-pressure cylinders to gusset plates between the deck and forward bulkhead of the engine room, and similar ties secure each of the after low-pressure cylinders to the structure of the vessel. The cylinder bottoms are separate castings, and are bolted to the cylinders, and they, together with the cylinder covers and the top and bottom covers of the valve casings, are of cast steel. The pistons are of forged steel, turned all over, and are fitted with two Perkins metal rings. The piston and connecting rods are of wrought steel and are hollow. The crosshead pin is fixed into the forks of the connecting rod, and is of steel, casehardened. The piston-rod guide and head are forged with the rod, and the guide has machined recesses on the "ahead" side, which are filled with white metal. The "ahead" guide faces are of cast iron, with water circulation at the back, and the "astern" faces are of bronze.

The bedplates are of cast steel; each consists of two angle-bar-shaped castings, which extend the whole length of the engine and rest on longitudinal frames extending between the engine-room bulkheads. The main bearing frames extend between and are checked into these castings, being secured to them, as well as to the floors of the vessel, by fitted bolts. The main bearings are eight in number, and wrought-steel columns braced together near the center form the connection between the cylinders and these frames.

The crank shafts and pins are hollow, and are of steel. The high-pressure and intermediate-pressure cranks are arranged opposite each other, and each pair of cranks is forged in one piece. Balance weights are fitted on the crank webs, reducing the vibration to a minimum. The thrusts and propeller shafts are also of steel, and are hollow. The propellers are three-bladed and are of manganese bronze, each being cast in one piece.

The condensers are placed in the wings, and are of brass. The steam is condensed outside the tubes, and the water is circulated through them by a natural flow, due to the speed of the vessel through the water, two of Gwynne's pumps being fitted as auxiliaries. The air pumps are single-acting, and are driven by cranks off the forward ends of the crank shafts, discharging into a common hot-well tank.

The boilers are fitted with galvanized steel tubes. They are worked under forced draft on the closed stokehold system, the air pressure being applied by two single-breasted fans in each stokehold, placed one on either side on the bunker bulkheads. The engines are of the open vertical type, and air is admitted to the fans by large cowls placed directly overhead.

The boiler-feed arrangement is most complete, consisting of a main and auxiliary system of feed pumps and pipes, which are separate and entirely independent of each other. The main system consists of two of Messrs. G. & J. Weir's special feed pumps, placed at the forward end of the engine room. Each draws from the hot-well tank through a Harris patent feed-water filter, discharging either to the boilers in one compartment direct or through one of a couple of Messrs. Weir's feed-water heaters, situated on the forward engine-room bulkhead between the pumps. The feed-water discharge to each boiler is controlled by a special automatic feed-regulating arrangement, which keeps the water at a steady level in the boiler, greatly relieving the engineer in charge. For the auxiliary system a similar feed pump is placed in each boiler room, and each pump is connected by separate pipes with the reserve fresh-water tank, the hot-well tank, and the sea, and discharges direct to the boilers. The pump in the after boiler room also discharges to the deck, and serves the purposes of a fire pump.

The main steam pipes are of galvanized steel. An independent pipe extends between each boiler room and one set of engines, and each pipe is fitted with a stop valve and steam separator on the engine-room bulkhead, thereby insuring dry steam in the engine. There is also a connecting pipe between the main steam pipes, and an equilibrium valve at each high-pressure cylinder. An independent auxiliary steam pipe supplies all the auxiliary engines, except the main feed pumps, and the exhaust steam is led by a system of pipes to either of the main condensers.

A large evaporator is situated amidships, on the after engine-room bulkhead, capable of evaporating 3,150 gallons of fresh water per day, with a distilling condenser beside it which can supply 560 gallons per day of pure aerated fresh water, chiefly used for ship purposes, the remainder of the vapor being condensed in the main condensers to serve as make-up feed. A separate engine, with pumps, is also fitted for maintaining the water level in the evaporators, circulating the condensing sea water, and pumping the drinking water into the ship's tanks. An auxiliary air pump is fitted to each of the circulating pumps, and is connected to the bottom of the main condensers discharging to the hot-well tank. On the after engine-room bulkhead there is also a duplex bilge pump for clearing out the bilges of the engine and boiler rooms, and ejectors have also been fitted to each compartment, so that in case of excessive flooding the water may be rapidly got rid of.

The supervision of the trials, on behalf of the Spanish Government, was in charge of the Spanish naval commission, under the presidency of Commodore Camara. The constructive department of the Spanish navy was represented by Captain Talero, and there were also present Captain Peral and Captain Carlier.

SWEDEN.

VESSELS PROPOSED OR BUILDING.

NJORD AND THOR.

Orders have been given for the construction of these two armored vessels of the *Oden* type (3,400 tons, p. 77, No. XIII). Each will have a battery of two 9.85-inch guns in turrets, one at each end; six 5.9-inch R. F. G.; ten 6-pounders; four machine guns, and one submerged torpedo tube.

ORNEN, EJDERN, AND JARNAN.

These are torpedo vessels provided for in the estimate of 1896–97, of which notice of the launch of the first and the beginning of the construction of the other two has been given.

IV.

NOTES ON ORDNANCE.

By Ensign LAY H. EVERHART, United States Navy.

Staff Intelligence Officer.

GUNS AND MOUNTS.

FRANCE.

CANET'S R. F. FIELD GUNS, 1896.

The R. F. field guns of the Canet system, 1896 model, include the following pieces:

Gun.	Length in calibers.	
	Long gun.	Short gun.
	Calibers.	*Calibers.*
75-millimeter (2.95-inch)	32	24
70-millimeter (2.76-inch)	32	24
65-millimeter (2.56-inch)	35	30

The carriages for these guns are particularly characterized by the employment of what are called "elastic" trail pieces.

The following are particulars of the 75-millimeter gun and mount:

	Long gun.	Short gun.
Weight of gun ... pounds	727.5	551
Weight of gun carriage ... do	1,433	1,102.3
Weight of gun and carriage ... do	2,160.5	1,653.3
Weight of carriage, limber, and gun ... do	3,428	2,777.8
Weight of projectile ... do	11.5	10.1
Initial velocity ... foot-seconds	1,968	1,640
Pressure per square inch ... pounds	31,290	31,290
Number in gun's crew	4	4
Shots per minute	10	10

CONSTRUCTION.

Each gun is composed of a tube on which is shrunk a long jacket which receives the breech plug, a trunnion hoop, and a locking hoop.

BREECH CLOSURES.

There are three types of breech closure for these guns. (Figs. 1, 2, and 3.)

First type.—Fig. 1 shows the breech opened, closed, and dismounted.

This plug is a cylindrical screw, and the various adjustments are simple. This system admits of rapid dismounting by hand, without tools.

The opening and closing of the breech are made by direct action in two successive motions of the lever.

The firing mechanism is automatically cocked during the rotary motion of the breech plug. This system can be used either with cartridge cases or ordinary gas check.

Second type.—Fig. 2 represents this type opened, closed, and dismounted.

In this system we have a conical plug; it can be manipulated very rapidly, but one motion of the lever being required to open or close the breech.

The firing mechanism is cocked in closing the breech. A useful feature of the firing mechanism of this type enables the firing pin to be cocked or released without opening the breech.

The mounting and dismounting can be done rapidly by hand without a special tool. Spare parts of the firing apparatus can be substituted for broken parts with ease.

This breech mechanism is adapted to use for obturating either cartridge cases or ordinary gas checks.

Third type.—This system (fig. 3) was fully described and illustrated in No. XV, page 99, and is here reproduced so that the different systems may be readily compared. It is called the concentric-groove system.

This entirely new mechanism is of very simple working, and includes in all five pieces. It opens and closes with a single quarter turn of the lever; at the position of open the breech itself forms a loading tray. It is composed essentially of a plug in the shape of a spherical segment bounded laterally by two flat surfaces and on the back by a concave cylindrical surface. A series of concentric grooves cut on the lateral surfaces of the plug fit in grooves of the same shape, cut in the breech of the gun.

The plug is dismounted simply by unscrewing the stop bolt, clearly seen on the right-hand side.

The firing mechanism is similar to that described for the second type.

These three types of mechanism are furnished with extractors which

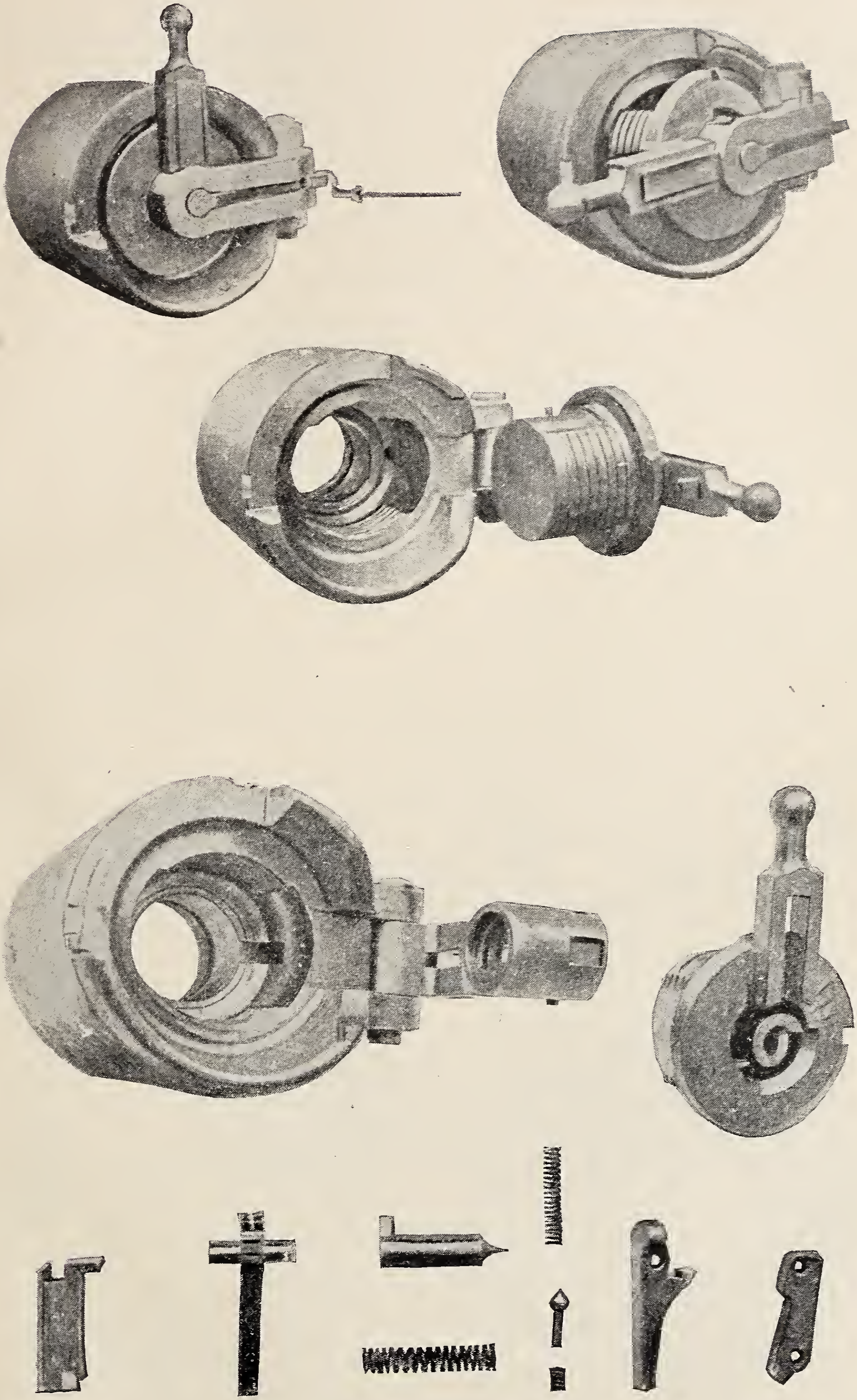


Fig. 1.—CANET'S BREECH MECHANISMS.

Revue d'Artillerie.

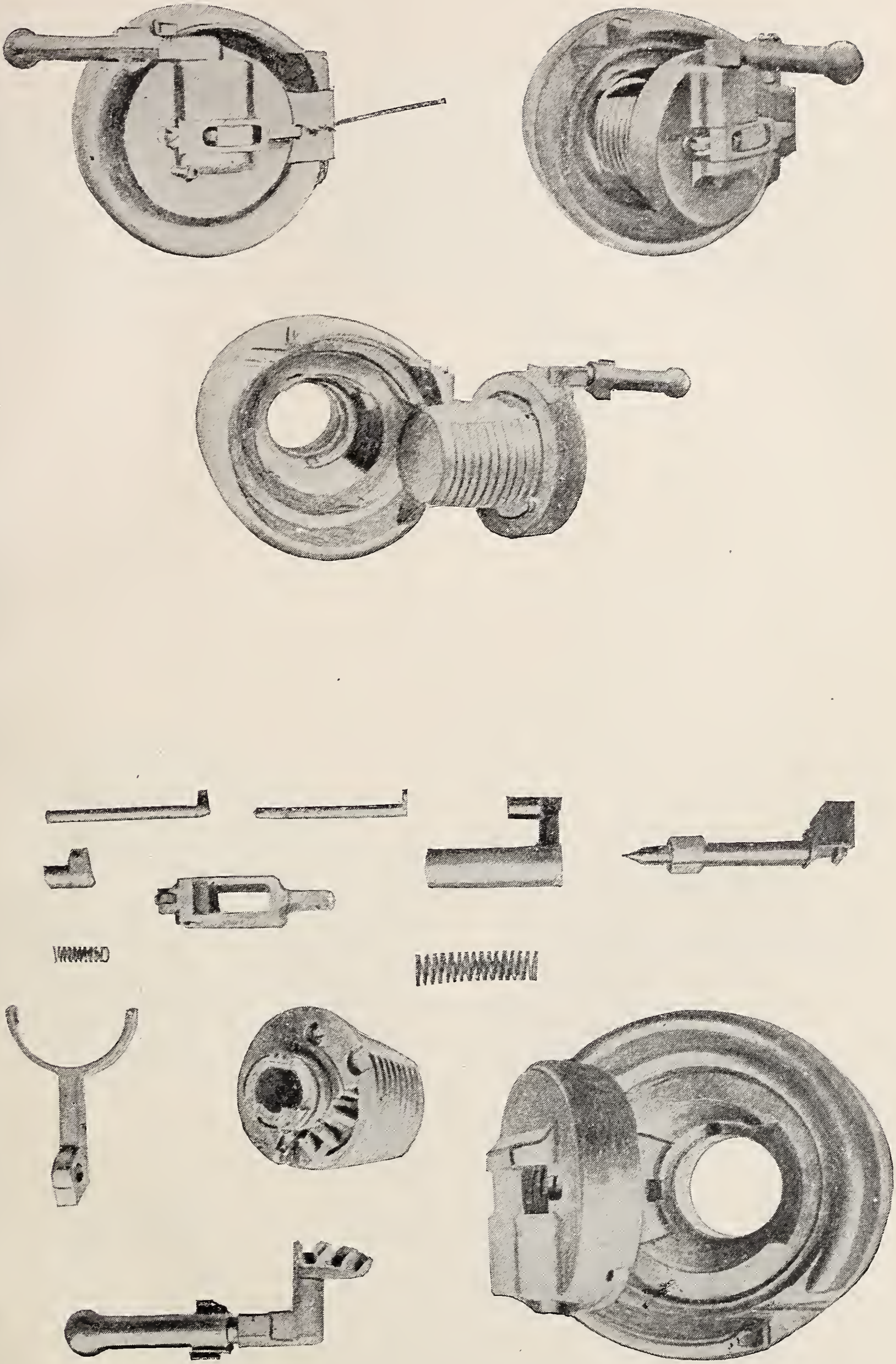


Fig. 2.—CANET'S BREECH MECHANISMS.

Revue d'Artillerie.

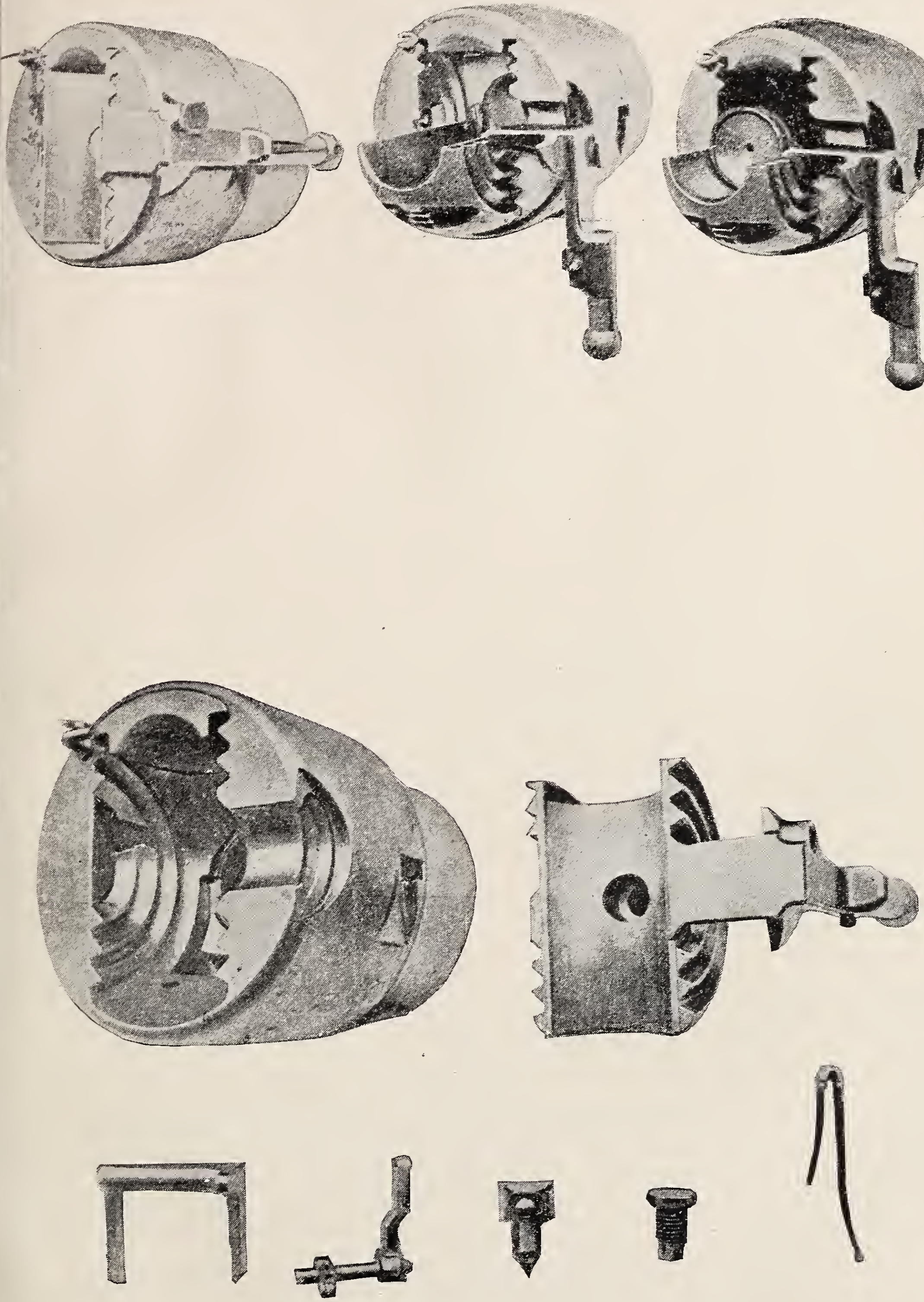


Fig. 3.—CANET'S BREECH MECHANISMS.

Revue d'Artillerie.

Fig. 4. Elevation.

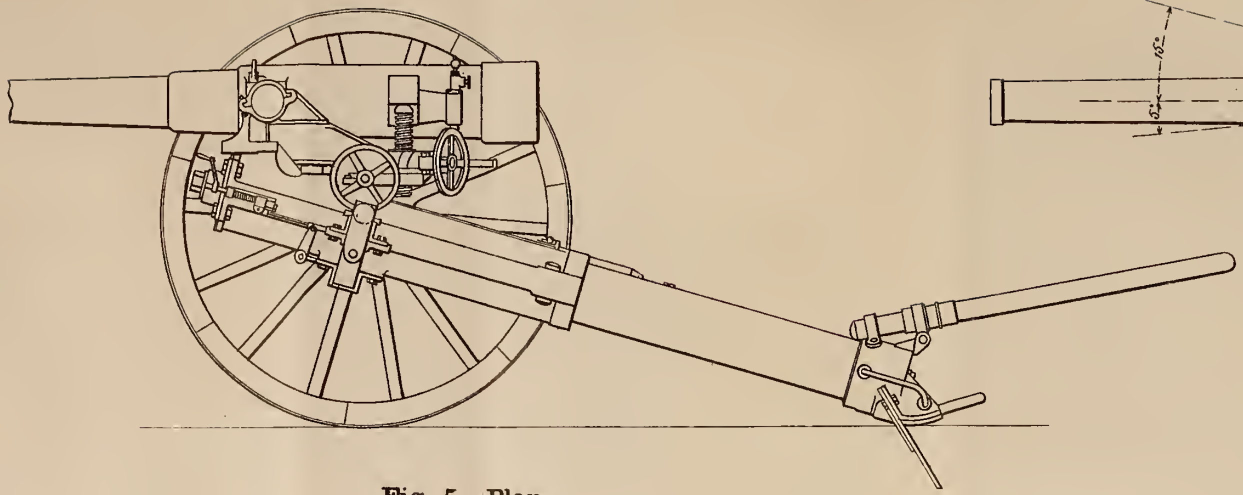


Fig. 6. Longitudinal section.

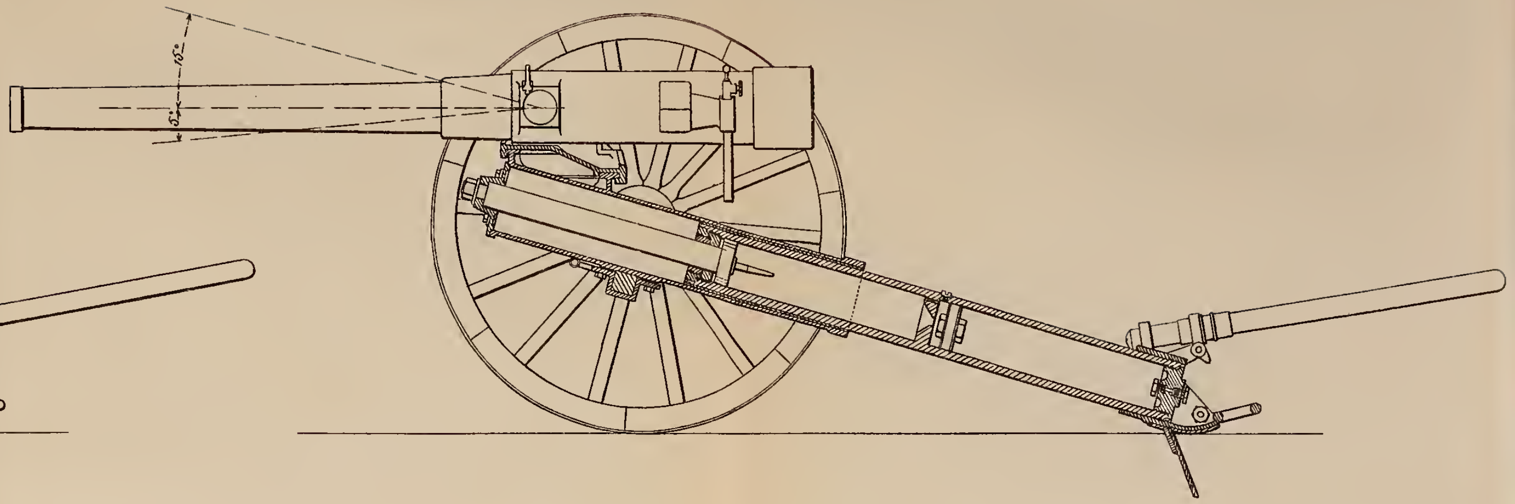


Fig. 5. Plan.

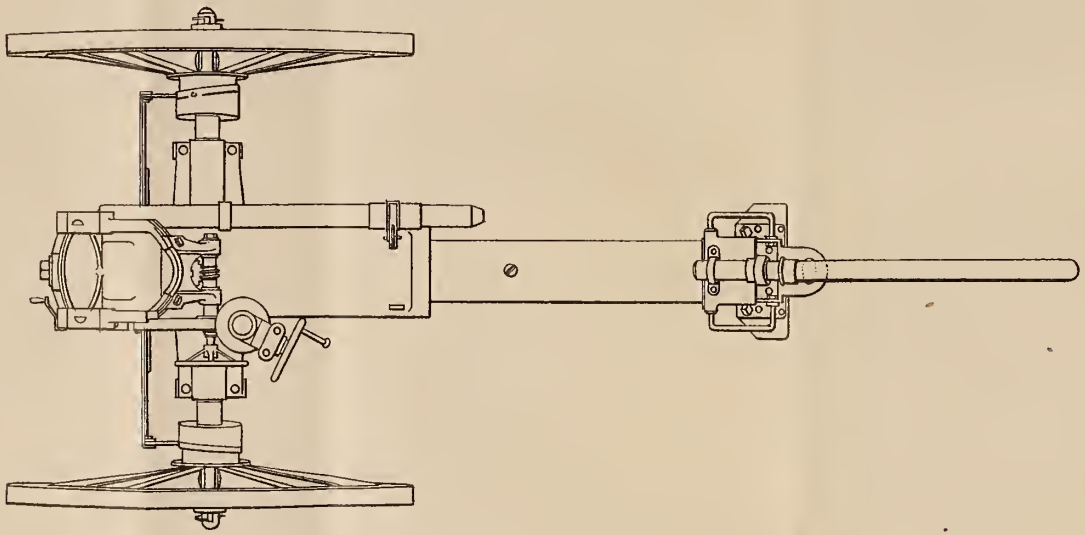


Fig. 7. Rear view.

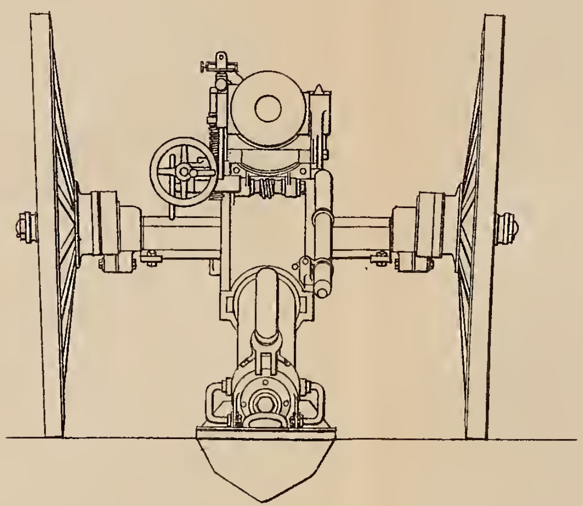
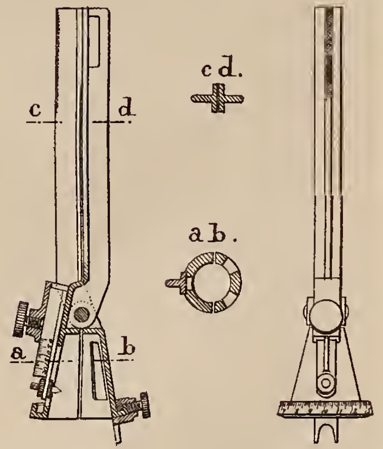


Fig. 8. Fuze cutter.



CANET'S ELASTIC TRAIL CARRIAGE.

"Revue d'Artillerie."

give an even and complete ejection of the cartridge cases; besides, they insure against premature fire, hang fire, and misfire. All three are equally well adapted to the use of percussion and electric primers.

The sights can be lighted by electricity at night.

THE CARRIAGE.

This gun carriage is called the "elastic trail" carriage, which name well defines its special features.

The trail.—The trail consists of two cast-steel tubes, one of which freely slides within the other under the action of recoil. This telescopic movement is controlled by means of a hydropneumatic brake. (Figs. 4, 5, 6, and 7.) The outer and larger tube is secured to the main body of the carriage, while the inner one terminates at its lower end with an inclined plate or spade, which enters the ground and takes the thrust of recoil. On the low end of the smaller tube, which is closed by a screw plug, is screwed a ring which carries the inclined plate, the two pointing rings, and lunette. The training lever, when the gun is limbered up, rests on the trail, and it has such a length that it bears against the rear face of the body of the carriage, thus making the system rigid.

Body of the gun carriage.—The body of the gun carriage is composed of the upper part of the trail and the axle, which are rigidly bracketed together. Above the axle is a circular rack, into which gears the training worm. The trunnions rest on a strongly made bracket frame, which pivots on the under body of the carriage.

Training and elevating gear.—The training mechanism consists of a worm gearing into the circular rack on the gun carriage, and forming part of a horizontal shaft; on this is mounted the handwheel, by means of which the gun can be trained within a field of 4 degrees each way. A little to the rear, and at the side of this handwheel, is a second one, which controls the elevation by means of a vertical screw, on the head of which rests the under side of the elevating and rear sight mass. The preponderance of the gun maintains this contact with the elevating screw.

Road brake.—The carriage is provided with a brake, to be used only on the road, and which must not under any conditions be tightened when firing. It is controlled by a crank handle, seen at the front of the gun carriage, which operates a transverse bar and two cams.

The axle.—The axle is of steel, curved in the center in order to pass round the tube beneath the gun carriage; it is also bent upward at the ends, so as to allow the use of wheels of a larger diameter than usual. The wheels are either partly of wood and partly of metal. or entirely of iron. In either case a lubricating device of a special type keeps the bearings in good running order.

Recoil brake.—The hydropneumatic brake controlling the recoil is of a new and simple type, containing improvements resulting from the experiments that have been made with this gun carriage during the last few years. This brake requires no special attention. Its endurance has been demonstrated, it is claimed, by a number of prolonged trials. Its position in the interior of a strong steel tube protects it from shock and from external influences.

The operation of the gun carriage when firing is automatic. At the first round the inclined plate or spade enters the ground. According to the nature of the soil, the reaction of the first round produces a recoil which may vary, but is more or less insignificant. This first round fixes the inclined plate in position, and with it the trail. At each subsequent round all the movable parts of the carriage recoil freely, telescoping, and actuating the hydropneumatic brake, but without raising the wheels from the ground. As soon as the energy of recoil is absorbed, the return into firing position takes place, and the gun carriage resumes at the end of this movement the position it occupied before firing. The operation of this system is in no way affected when the gun is trained to the maximum angle of 4 degrees. When the firing is over, or if a rapid change in training becomes necessary, the spade is easily disengaged from the ground.

AMMUNITION.

The ammunition used is of a new type. It consists of the two ordinary parts, projectiles and cartridge cases, packed in separate boxes for transport. Before loading, the projectile is fixed in the cartridge case by means of a special device. This method unites the advantages, it is claimed, of both systems of loading, the one in which the cartridge is complete, and the gun loaded in one movement; the other, where the cartridge case is separate from the projectile, and the gun is loaded in two operations; and it avoids the drawbacks attached to each. The cartridge cases and the projectiles are packed separately.

Cartridge cases.—The cartridge cases are made of brass or aluminum, and have either a percussion or an electric primer.

Projectiles.—In 100 rounds supplied, 90 are Canet shrapnel and 10 large-capacity steel shells for heavy charges. The shrapnel consists of a steel envelope inclosing a series of cast-iron disks, in which are set a number of hard-lead balls. A cast-iron-pointed head receives the fuze. The bursting charge is contained in a cavity at the back, which communicates by means of a tube with the fuze. Around this tube is a nonexplosive but inflammable substance which generates, at the moment of explosion, a thick volume of smoke visible at some distance, and which scatters, setting fire to combustable material. This shrapnel is fitted with an obturating ring near its head and a rifling band near its base.

The shells are of steel and have a solid head. They are fitted with base fuzes and have similar bands to those on the shrapnel.

Fuzes.—The fuzes are of brass or aluminum, and consist of a base percussion fuze for shell and a combination fuze for shrapnel. The time fuze is adjusted by means of an instrument which can be used

Fig. 9.

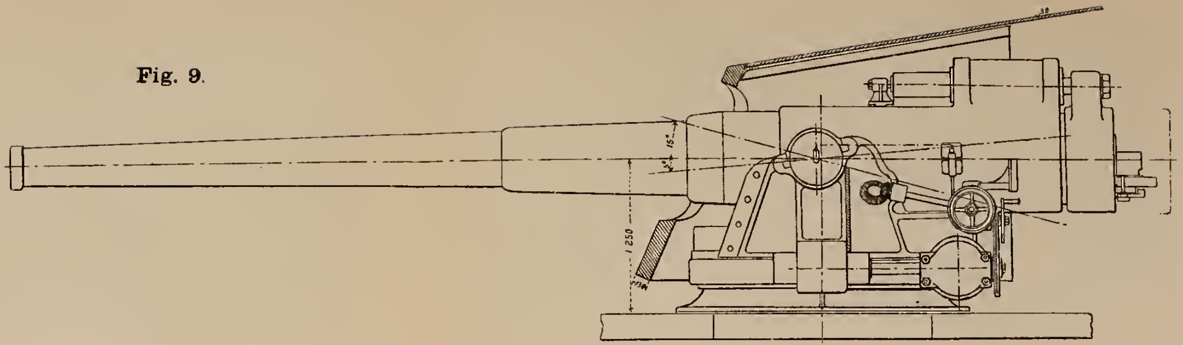


Fig. 10.

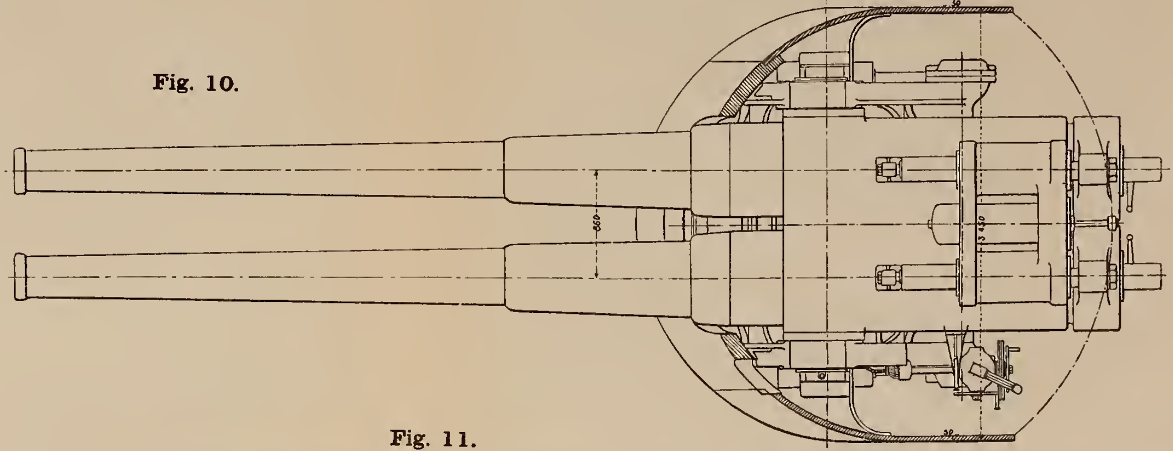


Fig. 11.

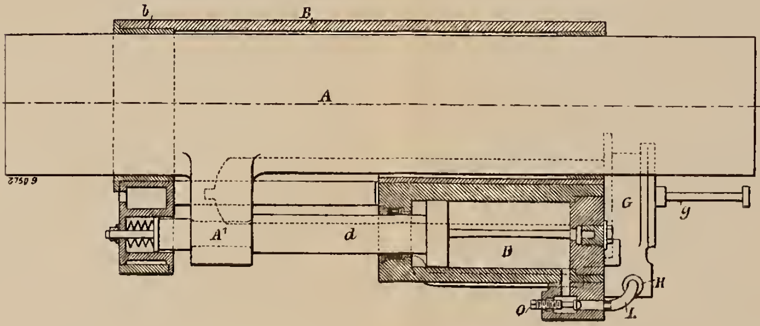
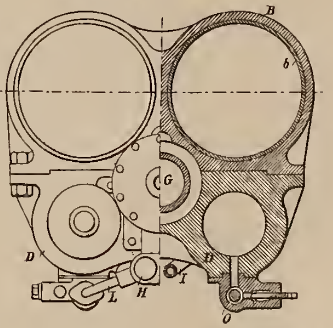


Fig. 12.



"Engineering."

CANET'S DUPLEX R. F. G. MOUNT.

without danger. It is in the form of a pair of shears (fig. 8) one leg of which ends in a hood, which entirely covers the fuze, while on the other leg runs a sliding piece holding a blade which cuts the slow match at the given point. A second sliding piece moves upon the lower edge of the hood, and can be fixed at any point by means of a screw; it has a notch, the hollow of which is of the same form as the projecting guide pin found upon many combination fuzes. When the two sliding pieces have been fixed at points corresponding to the desired length of fuze, all that has to be done is to cover the fuze with the hood and press the two legs of the instrument together.

Particulars of the 75-millimeter gun.

		Long.	Short.
Weight	pounds	726	550
Total length	feet	7.87	5.9
	calibers	32	24
Carriage:			
Weight	pounds	1,430	1,100
Height of trunnions	inches	39.4	39.4
Diameter of wheels	do	52	52
Distance between wheels	do	53	49
Extreme elevation	degrees	15	15
Extreme depression	do	5	5
Extreme train each way	do	4	4
Number of men to serve gun		4	4
Ammunition:			
Weight of shrapnel	pounds	11.4	10.1
Weight of shell	do	11.4	10.1
Weight of bursting charge	do	.88	.77
Weight of complete cartridge	do	15.4	13.2
Initial velocity	foot-seconds	1,968	1,640
Maximum range	yards	7,400	5,500
Limber:			
Weight	pounds	736	660
Number of rounds carried		35	35
Weight when loaded	pounds	1,265	1,122

CANET'S DUPLEX R. F. G. MOUNT.

This mount is a development of mounts installed on the *Captain Prat*, where the guns were in pairs and trained together, but elevated independently. (Illustrated in No. XIV, p. 70.) In the present mount the guns are closer together, have but two trunnions for the pair of guns, and train and elevate together. (Figs. 9 and 10.) On this mount the 200-millimeter (7.87 inches) R. F. G. are but 34 inches apart between axes of bores. The maximum elevation is 15 degrees and depression 5 degrees. The mount carries a 5-inch inclined shield with a roof of 1.2 inches. The illustrations (figs. 9 and 10) represent two 200-millimeter (7.87 inches) guns on the duplex mount placed on a revolving platform. The London Engineering, in describing this mount, says:

The mount is composed of a twin sleeve B surrounding the rear part of the guns and carrying in front the trunnions that are supported by the side brackets of the top carriage. On the upper part of the sleeve (the sections, figs. 11 and 12, show a modified arrangement) are the brake cylinders and the compressed-air reservoir by which the guns are returned to battery automatically; on the lower part of the sleeve is the locking slide of the elevating gear. The recoil brakes are of the Canet system, with the central rod of variable section. The brake plunger has on each side a rod of different diameter. The smaller extends backward, and is connected to a crosspiece fixed to the breech of each gun; the larger, *d*, enters the cylinder during the period of recoil and drives out a part of the liquid it contains; this liquid acts through a pipe and valve O L on the piston of the central cylinder G, in which the air is compressed in front of the piston. At the end of the recoil the valve closes, but a second pipe, open to both sides of the valve and controlled by a lever outside, allows the liquid previously driven out to flow back into the brake cylinder under the influence of the air compressed in the receiver, thus returning the gun to battery. According to whether the by-pass pipe is opened or closed at the moment of firing, the guns are run out at once or are held back. The central variable rods are fixed to the projections on the upper part of the sleeve. They move during recoil inside the piston rods, thus constantly changing the area of the openings of the brake. The sighting devices are attached to the sleeve on the mount.

The guns are elevated by a toothed sector fixed under the sleeve; into this gears a pinion worked through a countershaft by means of a hand controlling wheel and a transmission chain. The turning platform rests on a live ring of hard steel balls, and it can be trained either by hand or by an electric motor. The mechanism of this part of the mount comprises a fixed toothed ring, two pinions gearing into it, and a third pinion, on the shaft of which is mounted, by means of a special compensating device, a helicoidal gear. An endless screw drives this gear and is itself actuated either by a pair of beveled wheels connected with the electric motor or by chain transmission worked by hand. By means of a clutch the hand or power gear can be thrown at once into operation. A supply of ammunition is furnished to the gun by a central endless chain moving with the platform and delivering at the side of the mount. Provision can be made for a store of projectiles being placed close to the platform, in which case only the cartridges would have to be delivered from below. This kind of mount, which is applicable to all calibers of R. F. G., possesses the following advantages: The weight and bulk of the mounts are reduced to a large extent, and consequently the weight and cost of the shield and local armor are also reduced. The axes of the two guns being as near as possible, the strain arising from firing one gun is reduced to a minimum, consequently the wear of the mechanism from training is also reduced.

ELECTRIC TURRETS.

(Fig. 9, page 100, No. XV.)

Nothing but success seems to mark the development of electric control for turrets, and it appears to be only a question of time before we find it in general use for all sizes of turrets.

The 12-centimeter (4.72 inches) Krupp guns on the *Skiold* are mounted in armored turrets, which are elongated to rear, thus balancing the turret, as well as giving the gun's crew a maximum working space. The turret and gun mount rest on a steel platform which revolves upon rollers. The whole is carried upon a hollow inverted cone, which terminates in a hydraulic pivot, around which the entire system revolves. The ammunition is supplied to the gun through this hollow cone by a hand hoist. The hand-training gear, which may readily be substituted for the electric, consists of a winch, worked by two men on the lower deck, which actuates a pinion that gears in a rack secured to the steel platform.

The electric manipulator or motor by means of which the training is effected is shown in section in fig. 13 and in operation in fig 9, page 100, No. XV.

The velocity of rotation of the turret is easily regulated by operating the manipulator handle, which introduces or suppresses resistances in a sufficiently progressive manner, whatever may be the abruptness of the opening of the current.

The instantaneous stopping of the turret is effected by turning the handle, which breaks the current and at the same time short-circuits the motor brushes. The motor, thus converted into a generator, opposes its work to the motion of the turret. A special arrangement then permits the training of the turret handsomely. The turret is automatically stopped at the extremities of its train.

THE HOTCHKISS AUTOMATIC MACHINE GUN.

The following is a more complete description of the same gun briefly described in Part I, No. XVI, page 15:

The gun consists of a single barrel screwed into the front of the receiver which contains the operating mechanism; below and parallel to it is secured a hollow cylinder which is in communication with the bore through a port drilled through the barrel a few calibers from the muzzle. Contained in this cylinder is a piston on which are formed suitable cams for operating the bolt, the firing, and the feed mechanism. On discharge, as soon as the bullet has passed the port connecting bore and cylinder, the powder gas enters a chamber in the front end of the cylinder and throws the piston to the rear, where it is held by an ordinary sear. On releasing the sear by pressing the trigger the piston is thrown forward to its initial position by the main spring. If the sear is held out of engagement by pressing the trigger and the supply of cartridges be kept up, the piston will have a constant reciprocating motion.

The piston engages with the bolt, and by its motion opens the breech, pushes the cartridge into the chamber, closes the breech, and fires. On opening the breech it extracts the fired cartridge case and brings a fresh cartridge to the loading position, performing, in other words, the functions of a man's hand when operating a straight-pull rifle.

The cartridges are carried in flat brass feed strips, having a length of about 15 inches, and each containing thirty rounds. Each feed strip is packed in an ordinary pasteboard box, from which it is fed directly to the gun.

The feed mechanism consists of a feed wheel, which engages in cams cut in the piston, and register with openings formed in the feed strip; each backward and forward motion of the piston brings a fresh cartridge in line with the chamber ready to be pushed home by the bolt and fired.

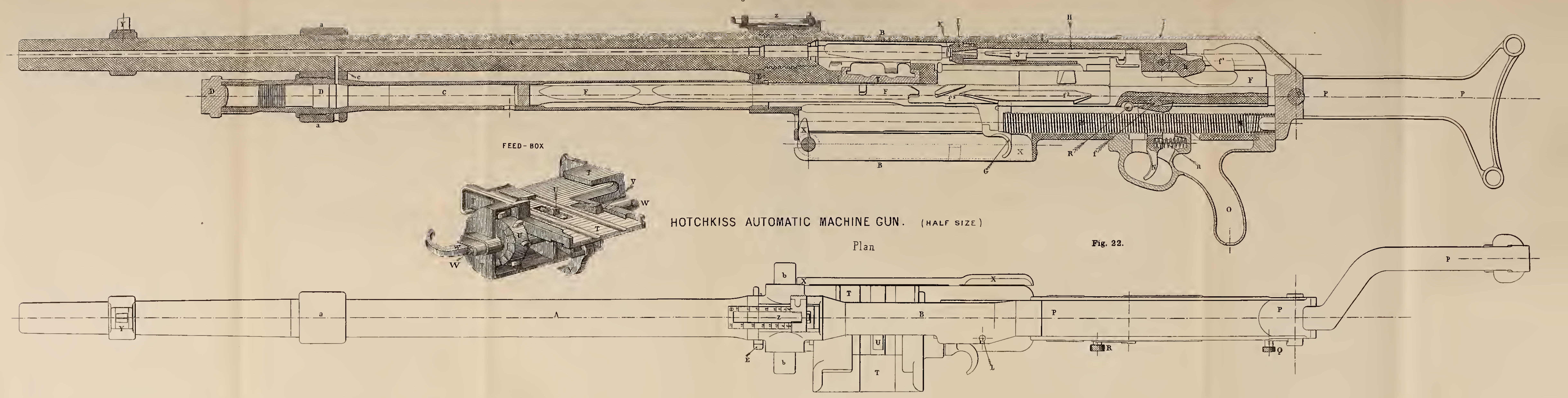
The gun is fitted with a shoulder piece or stock, which the gunner brings to his shoulder, and with a pistol grip and trigger for controlling the fire.

Two men are required to work the gun, one to load and the other to fire.

NOMENCLATURE OF PARTS.

[See figs. 22, 23, and 24.]

(A) Barrel	With cylinder collar (*a*) for supporting front end of cylinder.
(B) Receiver	With trunnions (*bb*) and seat for rear sight.
(C) Cylinder	In connection with barrel through port (*c*).
(D) Regulator	For varying capacity of cylinder chamber and consequently pressure on piston head.
(E) Securing key	For barrel and cylinder.
(F) Piston	Consisting of body with sear (f) and cams (f^1) for operating bolt, and stem with cams (f^2) for imparting intermittent motion to feed wheel.
(G) Finger piece	For cocking piston by hand for first shot, or in case of a misfire.
(H) Bolt	With locking dog (*h*).
(I) Nose piece	Supporting base of cartridge.
(J) Firing pin	Actuated by tang on body of piston.
(K) Extractor	Mounted on bolt, and securing nose piece.
(L) Ejector	Journaled in receiver, and actuated by bolt.
(M) Mainspring	Throwing piston forward.
(N) Trigger	With trigger spring (*n*).
(O) Pistol grip	With trigger guard.
(P) Shoulder piece	With breech cover (*p*).
(Q) Breech-cover pin	Fixing shoulder piece and breech cover to receiver.
(R) Safety lock	Preventing movement of piston.
Feed mechanism, self-contained, and consisting of:	
(S) Feed block	Containing the feed mechanism and forming a guide for the feed strips.
(T) Feed-block key	Fixing feed block to receiver.
(U) Feed wheel	For moving the feed strips and thus bringing each cartridge in front of chamber.
(V) Stop	With stop spring (*v*) for arresting piston at end of its backward course independently of trigger.
(W) Feed arbor	With pawl (*w*), engaging in ratchet on feed wheel, and pawl spring.
(X) Cocking lever	For starting piston in case of need.
(Y) Fore sight	Consisting of collar and leaf.
(Z) Rear sight	With sight block.



Longitudinal Section

FEED-BOX

HOTCHKISS AUTOMATIC MACHINE GUN. (HALF SIZE)

Plan

Fig. 22.

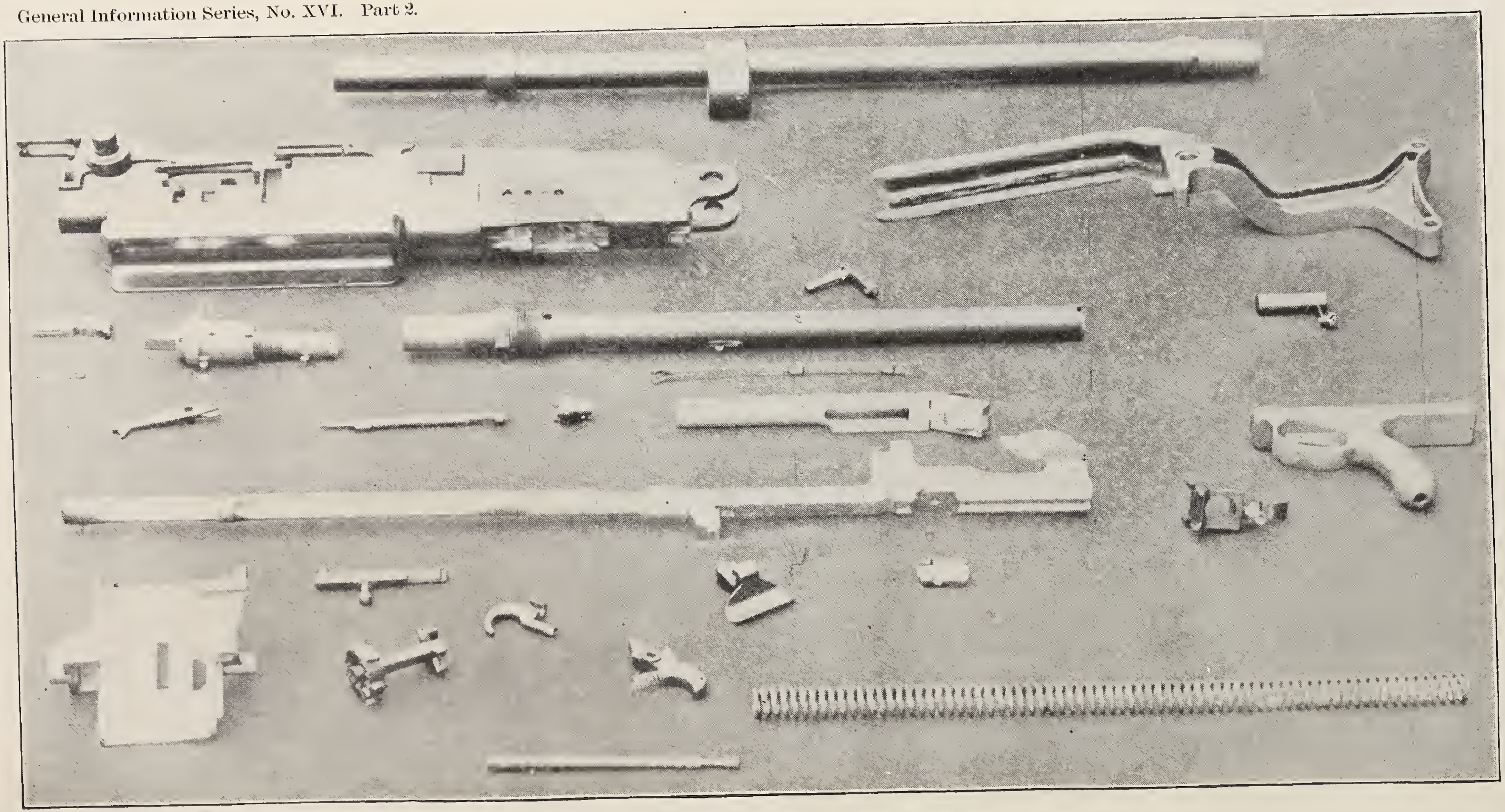


Fig. 23.—COMPONENT PARTS OF HOTCHKISS AUTOMATIC MACHINE GUN.

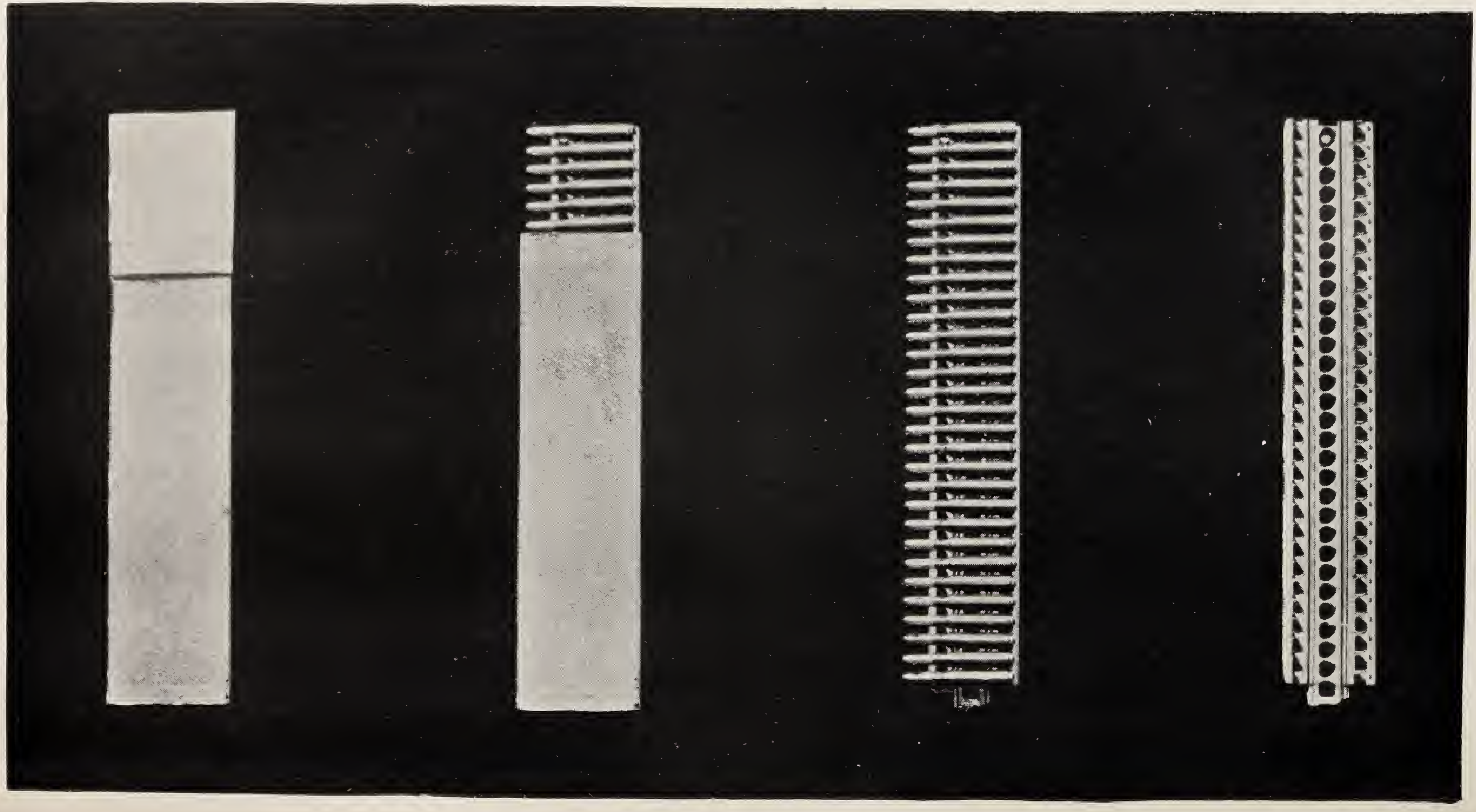


Fig. 24.—HOTCHKISS AUTOMATIC MACHINE GUN. FEED-STRIPS.

ACTION OF MECHANISM.

Assuming the breech to be closed, the gun is loaded by pushing a feed strip with cartridges into the feed block. The openings in the strip engage with the teeth of the feed wheel, which is now secured by the pawl engaging with the ratchet. Thus the first cartridge is held in position preparatory to the operation which brings it in line with the chamber and frees it from the strip. The stop which arrests the piston at the end of its backward motion is pressed down by the feed strip and so thrown out of action.

The gun is now cocked for the first shot by drawing the piston to the rear by means of the finger piece. This compresses the mainspring and causes the feed cam cut in the stem of piston to engage between two teeth of the feed wheel. Meanwhile the locking dog has been lifted by the unlocking cam formed on the body of the piston and the bolt withdrawn. The trigger engages with the sear, and the piston being held in its backward position, the gun is ready for firing.

On pressing the trigger the piston is released, and under the action of the mainspring is propelled forward, carrying with it the bolt; this, in moving forward, pushes a cartridge out of the feed strip into the chamber. When the cartridge is home the locking cam on the piston body brings the locking dog of the bolt to bear against the recoil blocks in the receiver. The breech now being closed and locked, the firing pin is driven against the primer by the tang on the piston and the cartridge is fired.

After the bullet has moved forward and passed the port connecting the bore with the cylinder, the powder gas drives the piston to the rear, withdrawing the bolt with its extractor, and ejecting the cartridge case. The piston is now held by the trigger, the mainspring compressed, and the gun is ready for the next shot.

The teeth of the feed wheel being engaged in the feed cams cut in the piston stem, each backward motion of the piston turns it one tooth and draws the feed strip forward bringing another cartridge to the loading position.

If the trigger be held back the piston is free to move forward again under the action of the compressed mainspring, and the fire will be kept up continuously and automatically until the supply of cartridges in the strip is exhausted.

The feed strip having been exhausted falls to the ground, and the stop which was held down by it rises and holds the piston in its backward position, independently of the trigger, and the piston is ready to move forward when the stop is again pressed down by a fresh feed strip.

In case of a miss fire the gun must be recocked by pulling back the finger piece; the defective cartridge is ejected by this motion and the firing may be continued.

In case a soft or defective fired cartridge case sticks in the chamber, and the gas pressure is insufficient to drive the piston back, it may be started by means of the cocking lever, and the gun recocked in the usual manner.

If it be required to withdraw a partially expended feed strip, the pawl is released from the ratchet of feed wheel by pulling the handle; the feed wheel is then free to turn backward, and the strip may be pulled out. This may be done with the breech either open or closed.

If it be required to lock the gun, turn the safety lock half a turn from "fire" to the "safety" position; the piston will be secured by the eccentric cam of the lock, either when the breech is open or closed.

The action of the mechanism depends in great measure on the pressure of the powder gas in the cylinder. The pressure may be increased by screwing down the regulator, or decreased by unscrewing the same. This varies the chamber capacity of the cylinder, and consequently the pressure.

MOUNTS.

Several types of mounts for this gun have been made, both for field, mountain, and naval service.

For land service the gun is generally used with a folding tripod, and transported on pack animals. (*See* figs. 25 and 26, and fig. 3, p. 14, Part I of No. XVI.)

On one pack is carried the gun, the tripod, the chest of spare parts and implements, and 600 rounds of ammunition.

On each ammunition pack is carried two chests, with 1,920 cartridges in feed strips, ready for firing.

The saddlery is similar to that used for light mountain artillery. The gun and tripod are carried in leather cases secured to the saddle and the accessory chest is attached to the saddle frame. They can be withdrawn without removing the cases from the pack. The ammunition is carried in two chests, secured above the cases.

The tripod consists of a socket, pivot, two legs, and a trail, the latter carrying a seat for the gunner. The gun forms, with the pivot and socket, a universal joint, and may be laid in any direction and elevation by means of the shoulder piece. The tripod can be converted into a litter by swinging the legs upward, and in this form can be carried by hand over considerable distances. With the legs swung upward, the gun may be brought close to the ground and fired, the gunner lying prone.

The tripod is fitted with an oscillator, which may be thrown in or out of gear, admitting a lateral movement up to 5 degrees.

Weight of gun pack:	Pounds.
(*a*) Saddlery, with gun and tripod, cases, waterproof cover, etc	66
Gun	33
Tripod	28.6
Chest, with accessories	22
Two chests, with 600 cartridges	63.8
Total	213.4

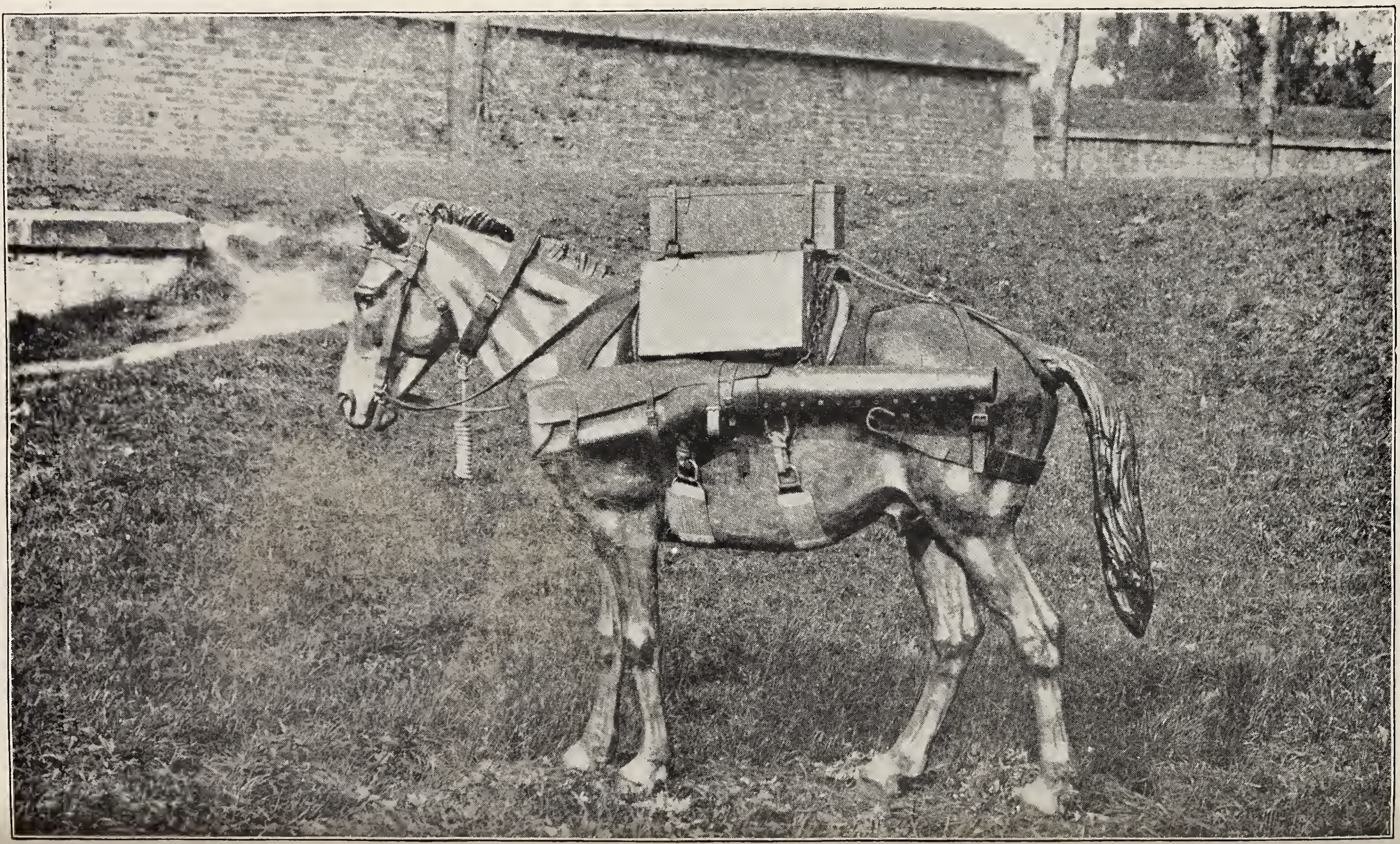


Fig. 25. HOTCHKISS AUTOMATIC MACHINE GUN, ON MULE.

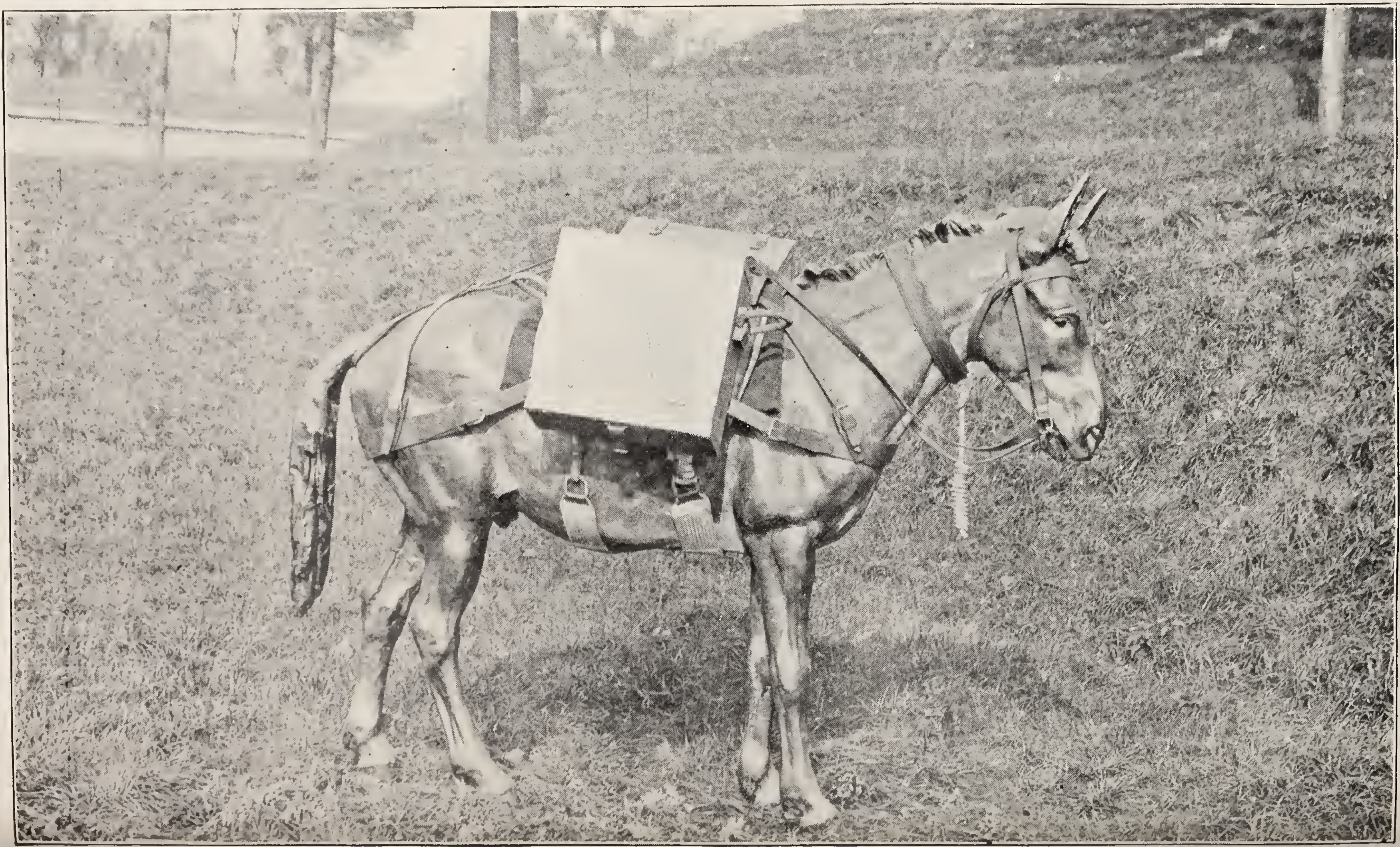


Fig. 26. AMMUNITION MULE FOR HOTCHKISS AUTOMATIC MACHINE GUN.

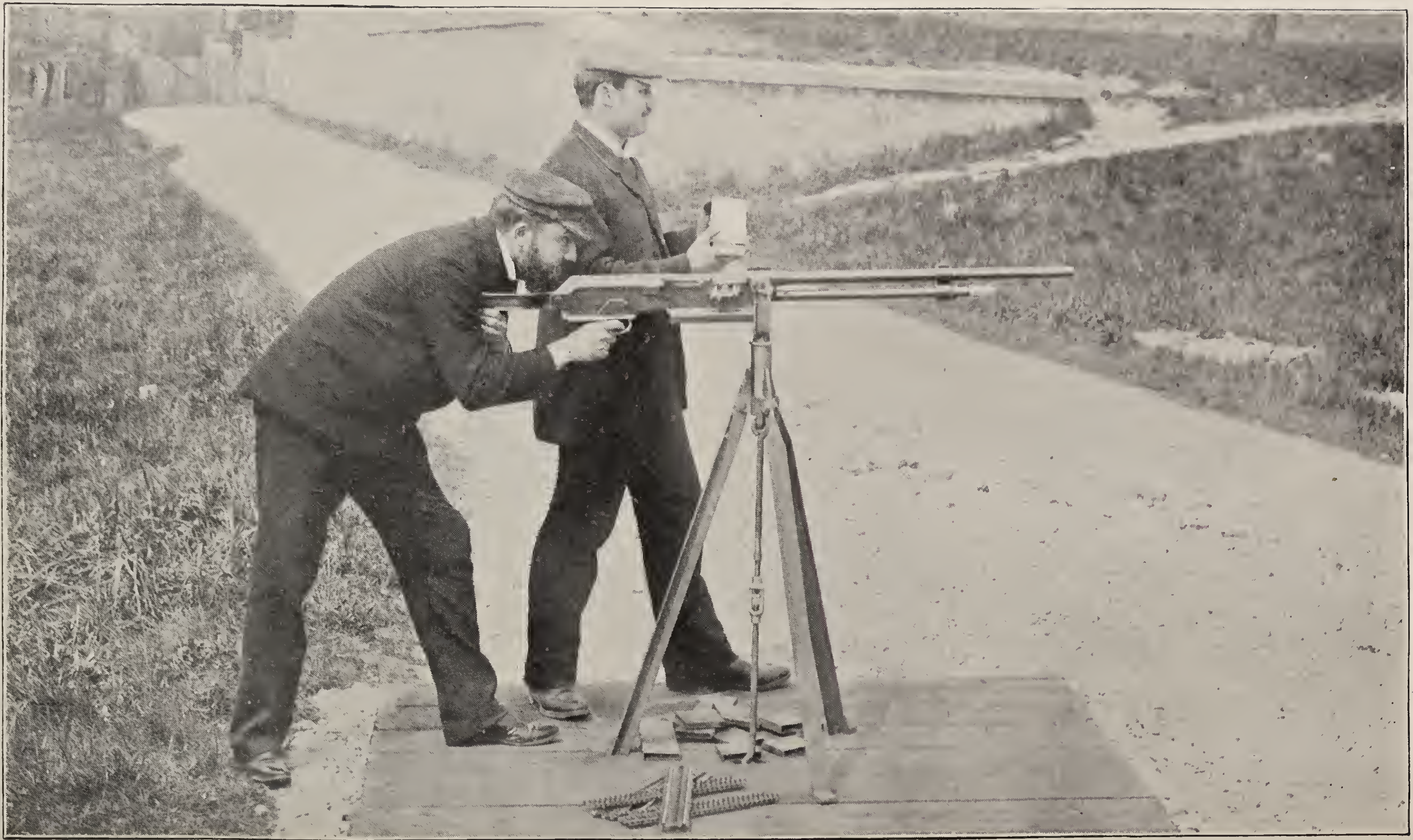


Fig. 28.—HOTCHKISS MACHINE GUN, ON NAVAL TRIPOD.

part of its length, the chamber section being tapered to allow of the free removal of the brass cartridge case. On the rear portion of this tube is shrunk a second tube, and round this is tightly wound the steel wire, the tension varying in successive layers as required. Over the wire is shrunk a jacket on which are cut steel keys to prevent any rotation of the gun by the inertia of the shell in the rifling. Finally, over the muzzle half of the A tube a chase hoop is shrunk on, and over the rear end of the jacket is screwed and shrunk the breech hoop, from the lower side of which projects a stout arm to which the piston rod of the recoil cylinder is secured.

These guns fire 100-pound projectiles with 13¼ pounds of cordite, obtaining an initial velocity of 2,200 foot-seconds.

The breech mechanism is the same as that described in No. XIII, page 89.

THE MOUNT.

The mounts for the 6-inch, Mark II, R. F. G. (figs. 14, 16, and 17), are of Elswick design and manufacture. They are constructed almost entirely of forged steel, only the recoil cylinder and tank and the mechanism for training and elevating being made of gun metal and bronze. Those for the main-deck guns and gun-deck guns are very similar in construction, the main point of difference being in the shape of the shield and the absence of a sighting platform, this being rendered unnecessary by the lowness of the gun-deck mounts. The cradles complete are identically the same for both positions, and nearly all the details for the training, elevating, and sighting gear are perfectly interchangeable. A great variety of stores and spare parts is thus obviated, and the similarity of the cradles renders it possible to repair a mount holding an important position from one less advantageously situated or thrown out of action by some serious damage to the carriage or pedestal.

The 6-inch R. F. mounts on board the British ship *Prince George* consist of a solid-steel pedestal A (figs. 16 and 17), having a broad circular base bolted firmly to the packing or foundation ring, which is built into the structure of the vessel. In this pedestal is a vertical hole, bushed at the upper end with a gun collar B, extending laterally over the upper face of the pedestal and having its periphery cut as a worm wheel. Within the pedestal at the bottom is a hardened-steel ring, on which rest a number of steel balls. On these balls rests a second steel plate, attached to the lower face of the shank of the carriage. The whole weight of the moving parts—gun, cradle, and carriage—is thus taken by a ball bearing, and training is rendered very easy. The gun carriage is a solid-steel forked forging C. The shank passes into the pedestal, being supported at its upper end by the broad gun-metal bush and at its lower end resting on the balls. In the fork of the carriage arrangement is made to receive the trunnions of the cradle. Firmly bolted to the sides of the carriage are steel-plate brackets for

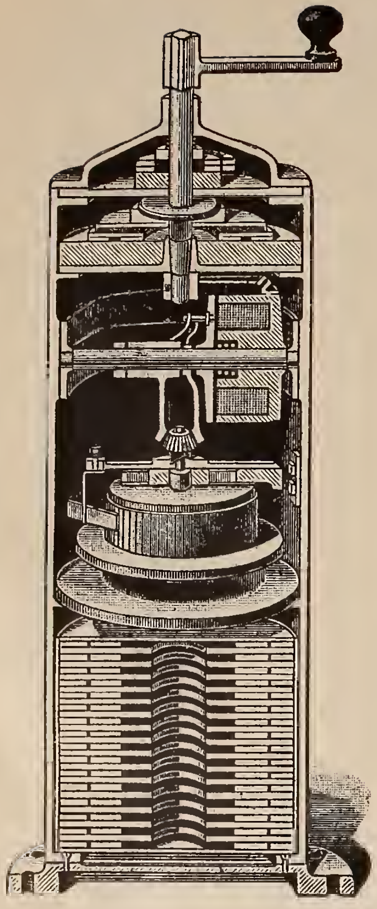


Fig. 13.

Electric Manipulator.

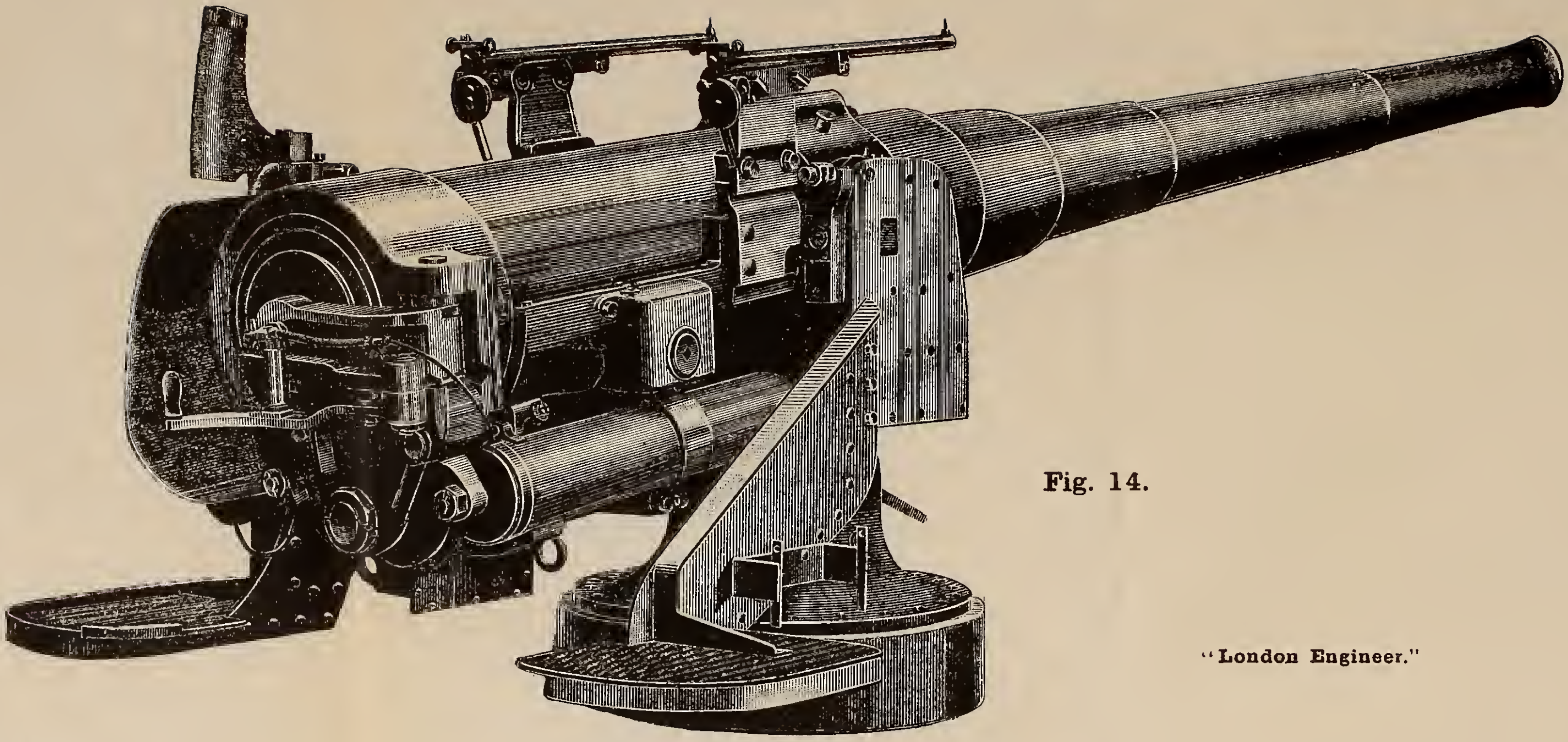


Fig. 14.

"London Engineer."

MAIN DECK MOUNT FOR THE 6 IN., MARK II, R. F. G.
(Shield removed.)

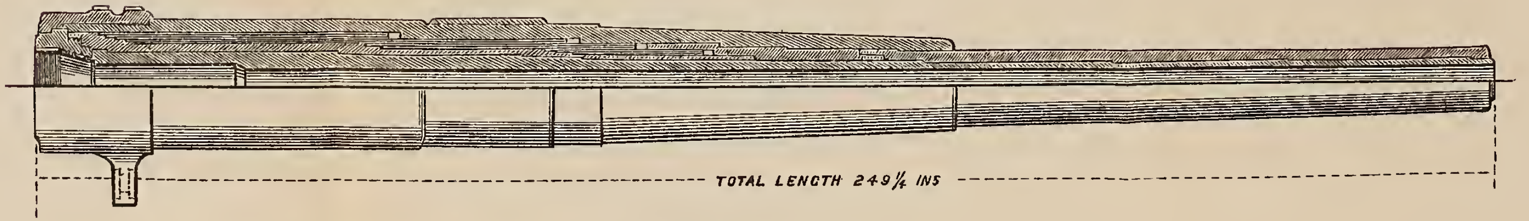
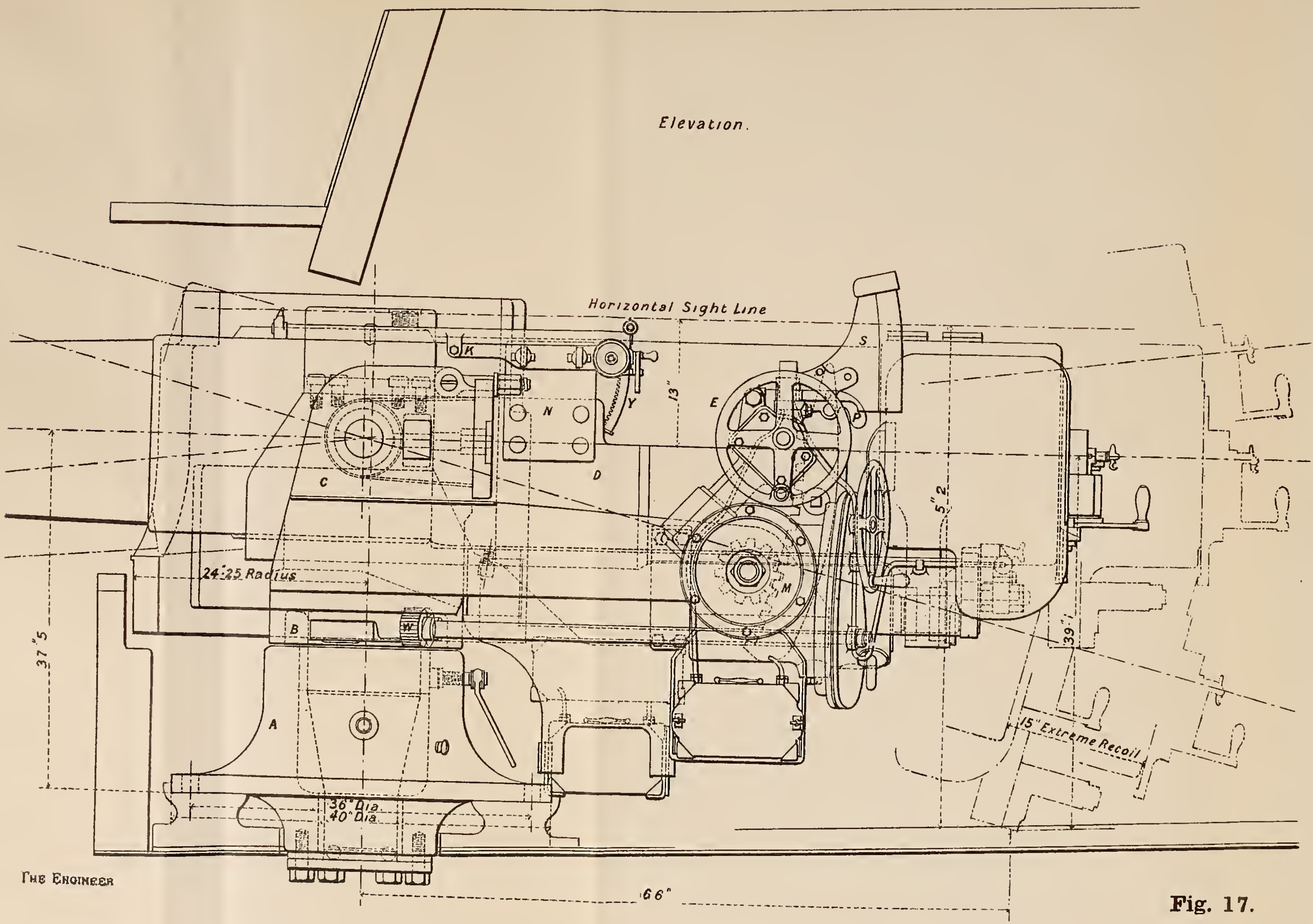


Fig. 15.

6 IN., MARK II, R. F. G.



THE ENGINEER

Fig. 17.

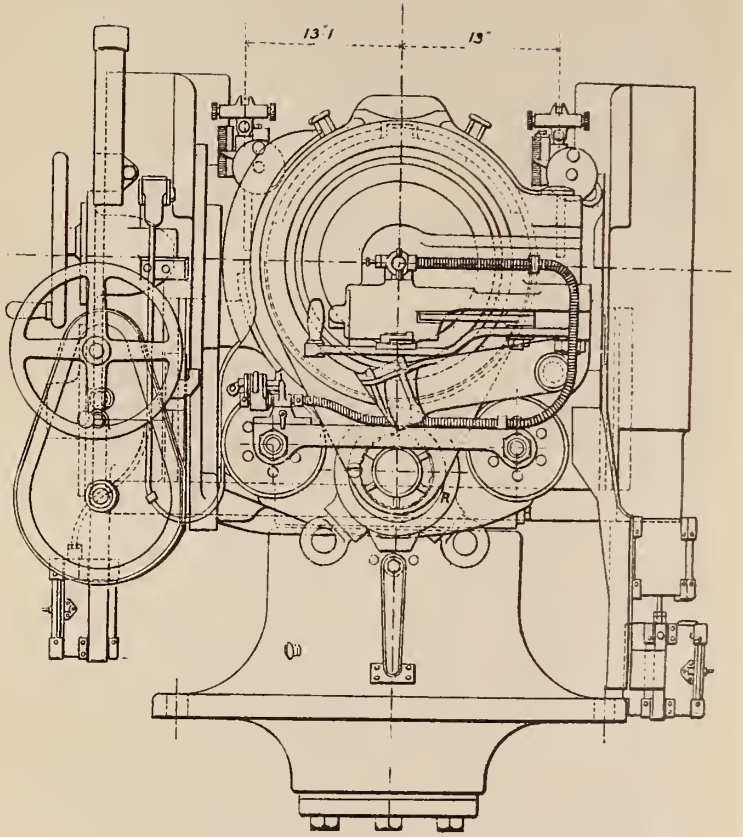


Fig. 16.

GUN DECK MOUNT FOR THE 6 IN., MARK II, R. F. G.

carrying the actuating mechanism and the platforms also in the upper-deck mounts. The elevating and training operations are performed by the turning of two handwheels conveniently placed with regard to the shoulder piece against which the gunner leans.

The training hand wheel is under his right hand, and revolves in a vertical plane nearly at right angles to the axis of the gun. It is connected with a rod, which passes toward the top of the pedestal by gearing, where it terminates in a worm W gearing with the worm-wheel edge of the pedestal bush described above. As this bush is firmly fixed it is evident that the rotation of the worm will cause the whole mount to revolve horizontally. The elevating handwheel E is under the control of the left hand. Elevation is produced by the revolution of a spur wheel M, gearing with the teeth of a circular arc attached to the cradle. The connection between this spur wheel and the handwheel is by a short train of wheels and a friction gear, consisting of several plates of gun metal and steel, alternately placed and pressed firmly together. One set of plates is attached to the spindle of the handwheel, the other to the spur wheel. The object of this arrangement is to allow the gun to move in a vertical plane without motion of the handwheel if for any reason it should be necessary to do so. It was originally employed in Vavasseur mounts to prevent any damage being caused by the muzzle of the gun, when at great elevation, recoiling against the top edge of the port, and has been maintained subsequently as a safety gear, though it very rarely comes into action. Normally the pressure between the plates is such as to make the connection practically rigid.

The gun cradle D is formed by a steel plate bent into a half circle. On its lower outer side at its rear end is attached the recoil cylinder R (figs. 16 and 17), of a high-class bronze, and on each side of this are placed the spring boxes. On the right side of the cradle is a gun-metal oil tank in direct communication with the recoil cylinder, and on the left side is attached the elevating arc referred to above. Within the cylinder is a piston having a very stout rod passing through a packed gland at the back end of the cylinder. On the end of the rod is a nut by which it is securely attached to a cross-bar and to the breech-ring of the gun. To each end of the cross-bar is also fastened a rod, which passes through a helical spring lying in each spring box. Projecting from the center of the solid bottom of the recoil cylinder is a bronze rod, known as the "control plunger," which enters into an axial hole drilled into the stout piston rod, but it is not a close fit. Out of the lower edge of the piston is cut a square notch, traveling over a valve key of peculiar shape lying on the lower side of the cylinder. In action the cylinder is filled with Rangoon oil. The springs normally hold the gun in the run-out position, and, consequently, the piston is kept close against the bottom of the cylinder. On firing, the pressure on the face of the breech screw drives the gun backwards. This action compresses the springs and pulls the piston along the cylinder, and by this means the oil is forced through the narrow passage left between the valve key and notch. By varying the area of this passage at every point the friction of the flowing oil is made to control the energy of recoil and to limit the motion to a length of 15 inches or thereabouts. After the limit of recoil has been reached the gun is immediately run out by the springs, the action in this direction being controlled by the plunger and a small automatic valve. The action is almost too rapid to be seen, and yet so nice are the calculations and adjustments that the mount only receives a slight shock, mainly taken up by the pedestal bush.

To each side of the cradle is firmly bolted a steel bracket N, rising a few inches above the upper edge. These brackets support the sights, one on each side. The form of sight used is known as the "bar and drum," and is illustrated in No. XIII, page 89. It consists mainly of a round steel tube pivoted near its center K to a bracket attached to the sight brackets on the cradle. The pivot, of course, only allows the bar to move in a vertical plane. To the front end of this bar is attached the fore sight, and to the back end the rear sight and the adjusting arc or scale Y. This latter is a steel piece in the form of the letter T, the vertical limb of the T being supposed long and curved at right angles to and toward the plane of the paper, and its lower end slightly inclined to the right. In the horizontal part the actual sight, or H, slides, being moved by a screw, and adjustment is thus made for the movement of the vessels and for the effect of wind. The slight bend to the right is to allow for drift. Teeth are cut in the curved vertical stalk Y, and by means of a pinion and worm and a small handwheel the sight can be moved to give the necessary angle of elevation. The 6 inch guns of the *Prince George* have maximum angles of 20 degrees elevation and 7 degrees depression.

A pistol grip is used for firing these guns electrically, and a lanyard for percussion firing. The gun can not be fired until the breech is fully closed and unless the primer is in working order. An electric sounder attached to the pistol grip P, and consisting simply of an armature beating on a magnet, tells audibly when the circuit is complete and the piece ready for firing. The batteries for firing and for lighting the electric-light sights are attached to the mount. The night sights consist of two tiny electric lamps, one red and the other white, which slip on over the day sights.

The shields for the main-deck guns have a circular front of 3¼-inch thick steel, and flat wings of thinner material; they have also a roof of steel 1¼ inches thick, slightly inclined, and formed in a circular arc of about 240 degrees. The gun projects through a port cut in the front of the shield, which is kept as small as compatible with the required elevation, by keeping the shield as close to the trunnions of the cradle as possible. The shields are attached to the mounts by bent steel stays or springs, which, giving under the blow, reduce the jar or

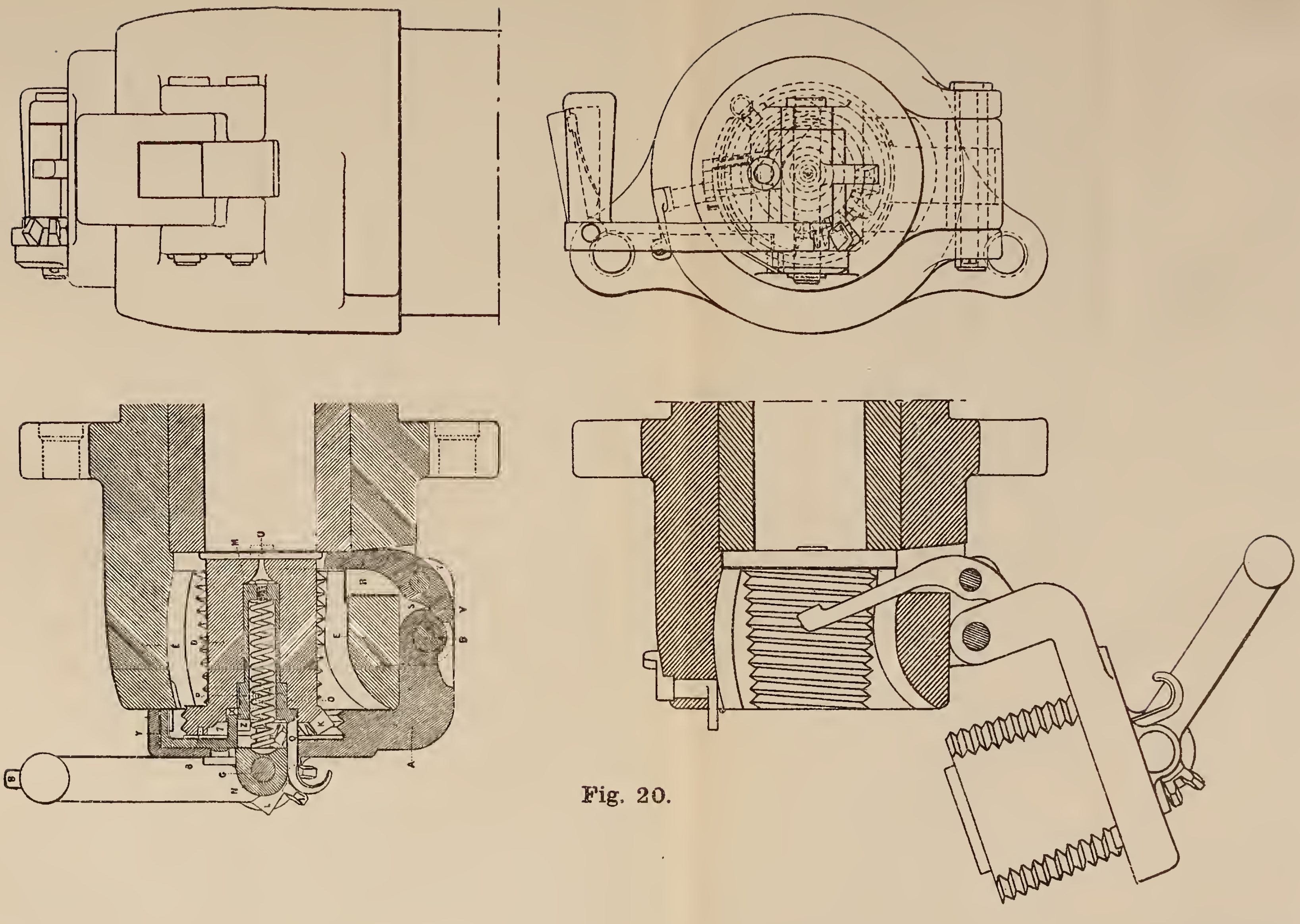


Fig. 20.

"London Engineer."

MAXIM-NORDENFELT R. F. FIELD GUN BREECH MECHANISM.

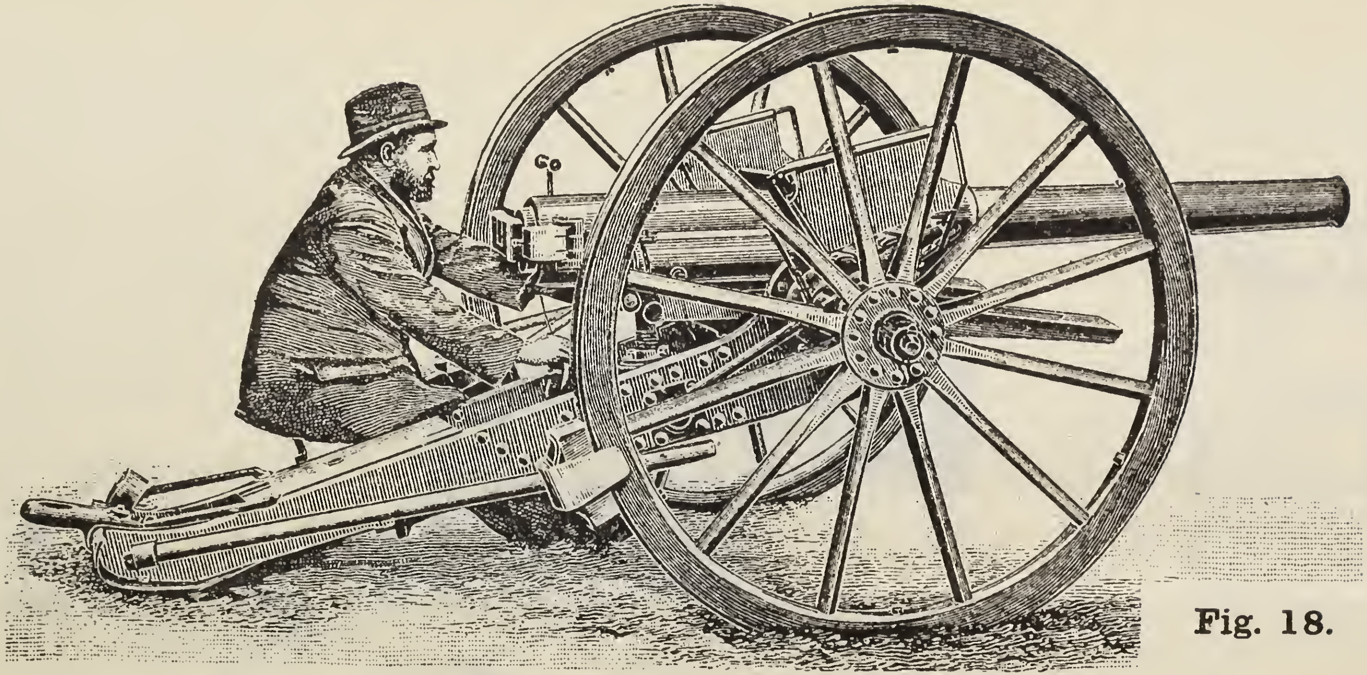


Fig. 18.

"Scientific American."

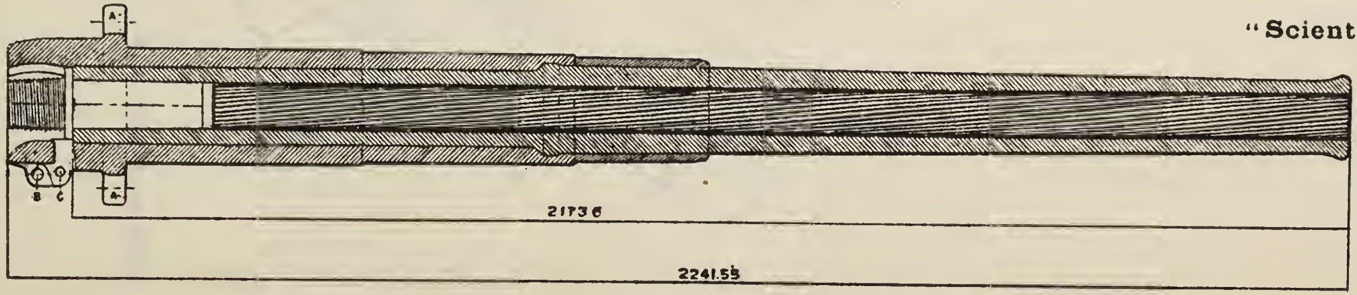


Fig. 19.

damage done by a shot, and so prevent the full destructive force taking effect. Ports for the sights are also cut through the shields.

These mounts are well balanced, the center of gravity being directly over the pivot. The effort required for training and elevating is very slight; provision is made for throwing the training gear out of action, and the mount can then be trained by a couple of men. A clamp through the pedestal box holds it in any desired position.

MAXIM-NORDENFELT R. F. FIELD GUNS.

The Maxim-Nordenfelt Company gives, in the London Engineer, the following data regarding their new R. F. field gun of 75-millimeter (2.95-inch) caliber:

The employment of fixed ammunition with primed metallic cartridge cases. Closing of the breech with an interrupted screw of simple and easy manipulation, and absolutely assuring extraction of the empty cartridge cases. Facilities for dismounting, without any tool, of the firing and breech-closing mechanism, admitting of the immediate change of a firing pin or of its spring. Recocking the gun without opening the breech. The employment of hydraulic recoil brakes, absorbing part of the recoil and reducing the jump of the carriage. Separate gear for training and elevating. Automatic brakes on the wheels. A light steel shield to protect the gunner against rifle bullets or shrapnel. Total weight of heavy equipment drawn not to exceed 3,968 pounds. Total weight of light equipment drawn—for horse artillery—not to exceed 3,307 pounds. Employment of a single projectile, with a few rounds of case shot.

The gun (fig. 19) is the ordinary tempered steel type. Being intended to slide in a cradle which forms part of the carriage, it does not carry trunnions. The two projections A receive the piston rods of the hydraulic brakes, while upon the right side of the breech are found the lugs B of the hinge for the breech-closing gear, and the lugs C forming the supports of the extractor. The grooves of the rifling are thirty in number, uniform, and their angle of inclination is 6 degrees. Their width is 0.228 inch at the commencement, diminishes gradually to 0.193 inch at the muzzle, causing a continual compression of the driving ring during the passage of the projectile through the bore of the gun, which diminishes the chance of gas escape and consequently of erosion. The depth of the grooves is 0.228 inch.

The breech-closing gear is somewhat different to any hitherto employed. The breech screw D (fig. 20) is actually conical, but the largest diameter is at its interior extremity. Nevertheless it hinges out upon the carrier A without any longitudinal movement being required, the seating E being sloped away to a certain extent to admit of this. This arrangement is said to obviate all possibility of the breech plug being forced out by excessive pressures. The extremity of the lever F has a segmental pinion I engaging with a cogged segment K in the breechblock. The first portion of the movement then makes the block revolve through 90 degrees, the cogs of the pinion being placed eccentrically to its axis, so that they recede as the block goes out and preserve their engagement. A claw on the pinion now sets against the breech plug and brings it out, instead of making it revolve further. The 90-degree revolution brings the threaded portions of the screw against the smooth portions of the breech. The firing pin M is actuated by a spring pressing between the sleeve N and its solid point. Turning the breech plug presses the two helicoidal surfaces O upon projections P behind the firing pin and cocks the gun, the firing pin itself being prevented from rotating by the directing arm Q, which can only work longitudinally.

This directing arm is prolonged beyond the carrier and ends in a hook, by which the gun can be recocked in case of a misfire without opening the breech. The extractor R oscillates around an axis S fixed in the two lugs T; it has two extracting claws V. By the movement of the curved heel V the process of extraction, slow at first, finally ejects the empty cartridge case with a jerk. The ordinary trigger mechanism is seen at X, Y, Z, and the firing lever 2. A safety trigger, composed of a heel at the end of the prolongation of Y, slides in the groove 5 and prevents the act of firing until the moment when the breech is closed. The breech plug is prevented from oscillating unduly around its axis by a spring button 7. A bent lever, actuated by a spring, secures the working lever of the gun in its position against the breech when closed. The breech-closing gear is provided, when required, with an arrangement for preventing the opening of the breech in the event of a hang fire. It is only released by the shock of discharge.

The carriage has a jacket or cradle A (figs 18 and 21) of cast steel, in which the gun slides, fitted with hydraulic brake cylinders, favorably situated with regard to the axis of the gun and the line of recoil. The recoil in the cylinders is 12 inches. The gun jacket and hydraulic brake are upon a simicircular platform E, being secured by the clamps D and D′. The pivot E is the center of movement of the whole system for a training of 9 degrees. The lower part of the pivot F and the cushion G work by a screw upon the fixed cylindrical axis H, secured to both brackets of the carriage. It will be seen by a reference to the drawing that the axis of the gun is low down, and very near the center of the axletree, and consequently that the angle of the trail is a very acute one, if the wheels are of the ordinary height. This is a general advantage, as it tends to prevent jump. A cogged segment L engaging with the endless screw M, manipulated by the training wheel N, gives train through an arc of 9 degrees without altering the position of the trail. The elevating screw and wheel can be seen at P and S. They admit of 15 degrees of elevation and 5 degrees of depression.

The sights are fixed upon the side of the jacket, and consequently do not recoil with the gun. This is a manifest advantage. The training

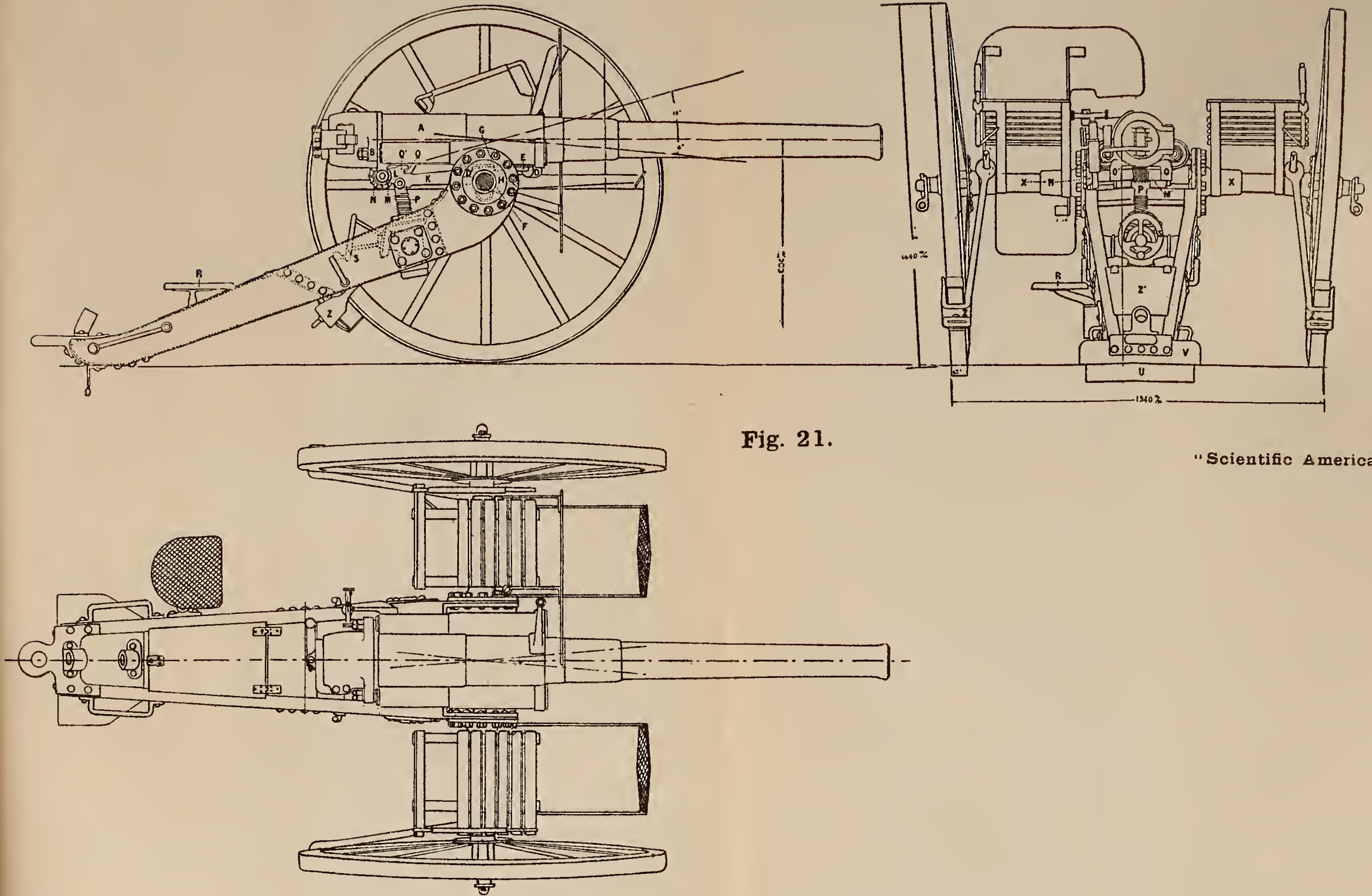


Fig. 21.

"Scientific American."

MAXIM-NORDENFELT 75 mm. (2".95) R. F. FIELD GUN CARRIAGE.

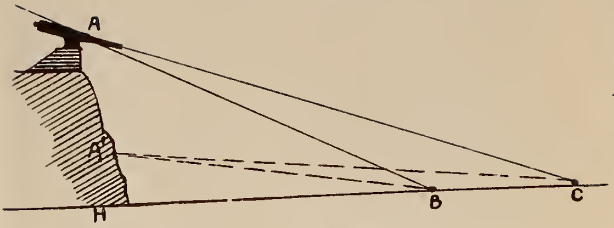


Fig. 29.

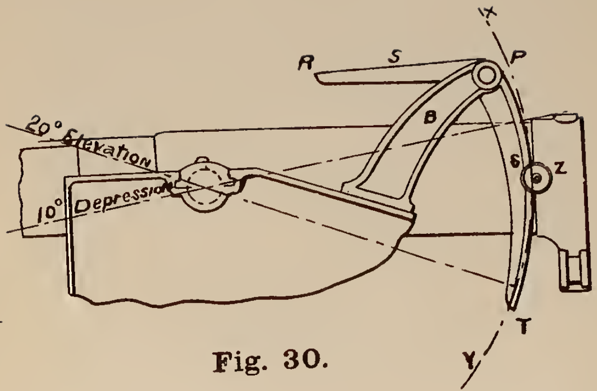


Fig. 30.

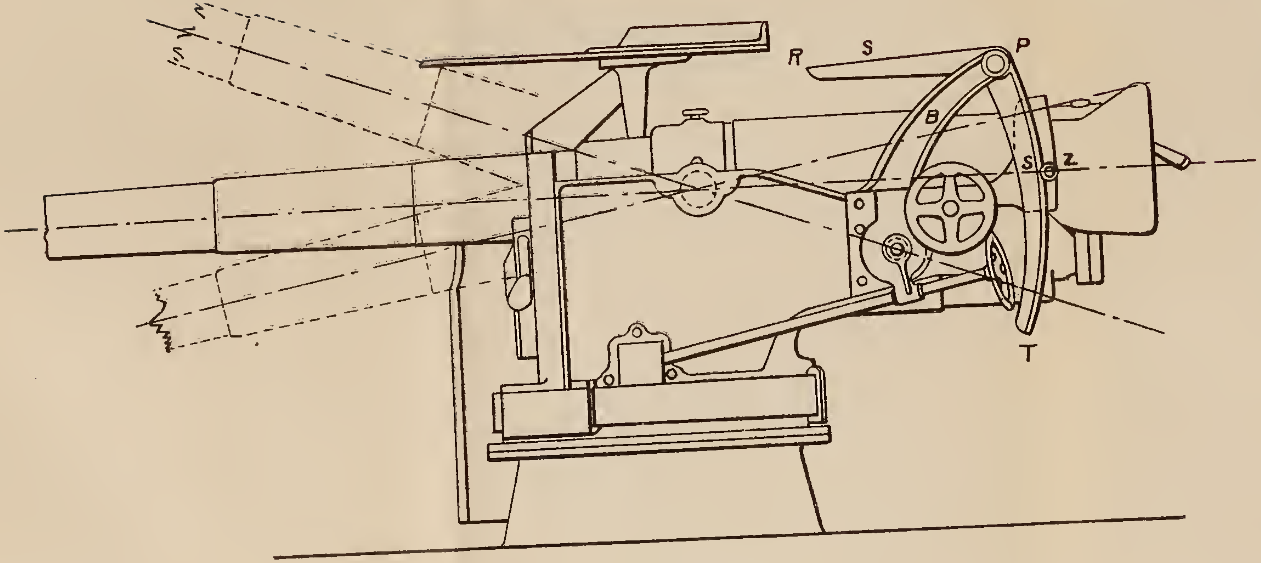


Fig. 31

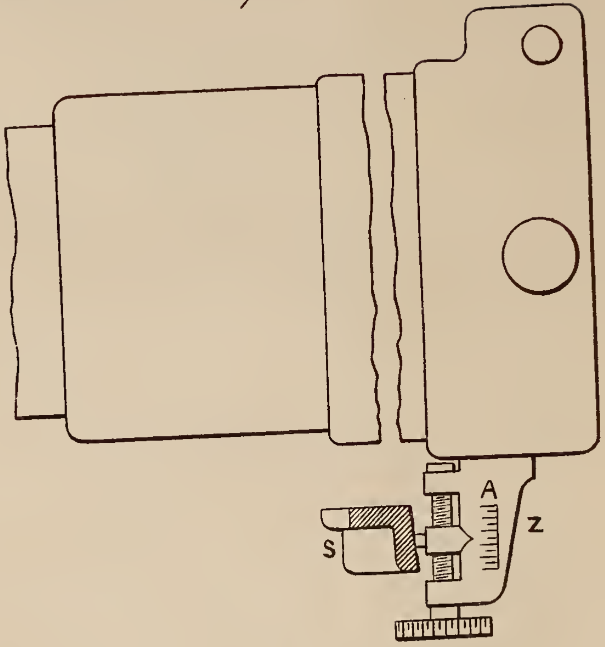


Fig. 32.

"Engineering."

GAYNOR AUTOMATIC SIGHT.

and elevating wheels are so placed that the gunner, seated upon the seat R, can without any inconvenience elevate, having the right hand upon the wheel S, while with the left he works the training wheel N. The elevation once obtained, his right hand is free to pull the trigger and fire the gun. The extremity of the trail is provided with a short spade U for the purpose of further checking the recoil, fixed beneath a plate V sufficiently large to prevent the burying of the trail in the ground. The axletree carries at each side, near the wheels, a ring Y, the position of which is slightly eccentric in regard to its axis, each ring receiving the end of a drag iron Z intended to skid the wheels during firing. These drags are in all respects automatic, for the more the wheels have a tendency to turn during recoil the more firmly are they skidded. On the march the drags are hung at either side of the trail. Z′ is a trail box for tools, sights, spare parts, etc. The carriage is provided with a steel shield.

The following are the principal dimensions and particulars:

	Heavy gun.	Light gun.
Caliber of gun ... inches	2.95	2.95
Length of gun ... calibers	30	24.50
Weight of gun and breech gear ... pounds	734	624
Height of axis of gun above ground ... inches	36.3	33.2
Weight of the carriage with wheels ... pounds	1,828	1,431
Angle of recoil upon the ground ... degrees	30	30
Weight of loaded projectile (shrapnel) ... pounds	13	11.75
Weight of round complete of fixed ammunition ... do	16	14

The fixed ammunition is loaded horizontally in limber boxes, thirty-six rounds being carried with the heavy-gun equipment and forty-eight rounds with the horse-artillery equipment upon the gun limber. The initial velocity with the heavy gun is about 1,640 foot-seconds.

THE GAYNOR AUTOMATIC SIGHT.

This sight is for use on guns in seacoast fortifications which are at a high elevation above the sea level, so that the sight will automatically adjust itself to the required range in the act of elevating or depressing the gun in the operation of pointing at the object.

The high command is necessary to the working of an automatic sight. Suppose a gun to be at A (fig. 29), at the elevation of AH above the sea level, and pointed at an object C; then to point at some other object B the gun must be depressed through the considerable angle CAB, which motion is utilized to automatically adjust the sight. At some low elevation A′ the angle CA′B becomes very small and the automatic sight becomes unreliable, and at the sea level H there is no function of range available for an automatic adjustment of the sight.

In the Gaynor sight adjustment is provided for the rise and fall of the tide and for drift. The illustrations (figs. 30, 31, and 32) show the general arrangement. The sight complete is composed of the bell crank RPT, pivoted at P to the bracket B and the adjuster Z. The pin P is set at an angle to compensate for drift. The line of sight is over the edge PR. The bracket B is secured to the trunnion bracket and the adjuster to the gun itself, so that in moving the gun in elevation Z passes over the curved edge PT, which is so constructed as to give the sight the proper movement. Z always passing in the arc XY, which intersects the curve PT, causes the sight PR to move so that it always points at the spot the shot will strike.

The correction for the rise and fall of the tide is made by the adjuster Z (fig. 32). For every stage of the tide there is different curve PT, and all of these curves are represented on the face of the lower arc S of the bell crank. The scale A (fig. 32) shows the proper point of adjustment for a particular height of tide.

JAPAN.

R. F. FIELD AND MOUNTAIN GUNS.

The Société des Forges et Chantiers de la Mediterranée, of La Seyne, France, have recently supplied the Japanese Government with an experimental lot of field and mountain guns, similar in design to the Canet guns, previously described, but, it is claimed, of improved construction and reduced weight.

The field gun weighs, when fully equipped, about 3,140 pounds. The breech mechanism of the field gun is different from those described on page 2, as can be seen by referring to figs. 34 and 36. It is operated by a single movement of the lever at the right side of the breech, and on opening the breech the plug revolves downward. Its weight thus assists in ejecting the empty cartridge cases. The caissons are light and are fitted with special springs to protect the cartridges from damage by jolting. The caisson carries 35 rounds of ammunition on the limber and 60 on the body.

The R. F. mountain gun is shown in fig. 35. The gun itself is easily transported by one mule. The breech mechanism fitted to this gun is the same as that described on page 2, in which two motions of the lever are required to open or close the breech. The carriages are like the new Canet carriages, and the parts can be carried by two mules.

RUSSIA.

23-CENTIMETER (9-INCH) B. L. R. MORTAR.

By an order dated in November, 1896, this mortar has been definitely decided upon. It is of 23-centimeter (9-inch) caliber, and is 175.2 centimeters (69 inches) long, or 7.7 calibers. There are 52 grooves, the rifling being progressive (parabolic) through one turn of 102.2 centimeters (40.2 inches), and then constant. The initial angle of inclination

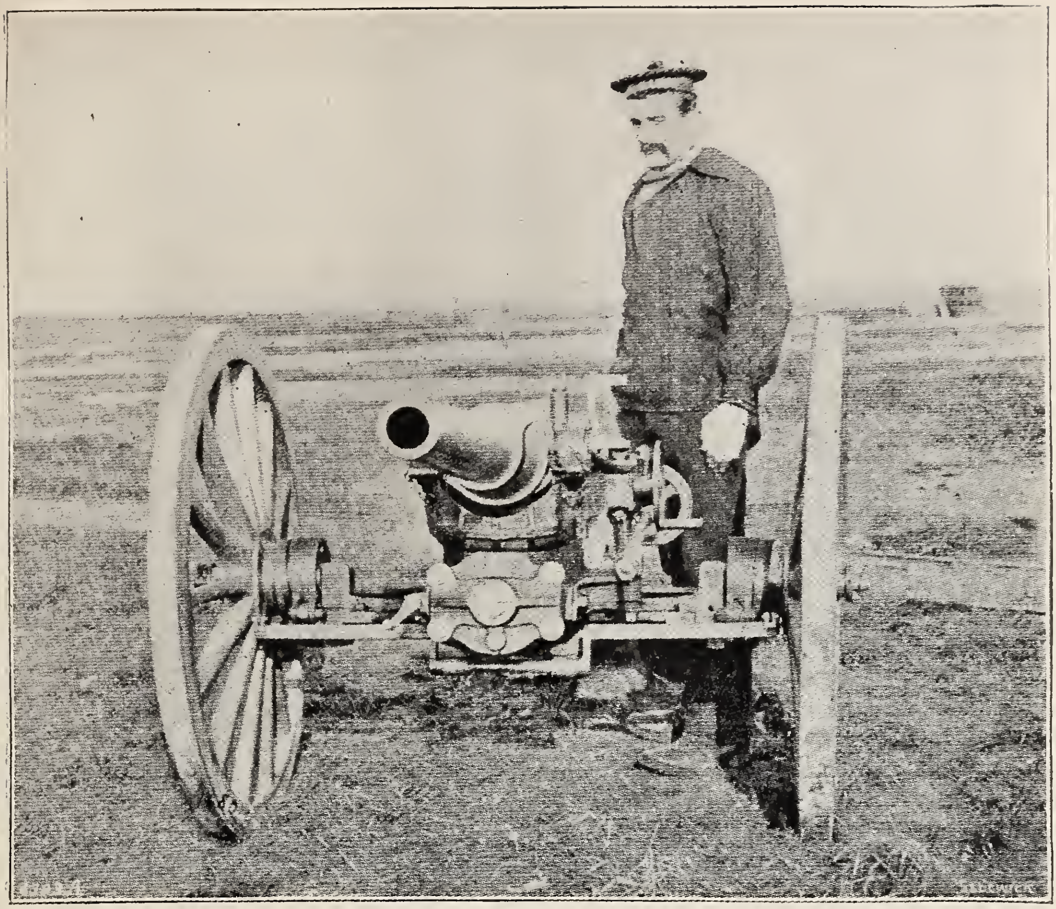


Fig. 33.

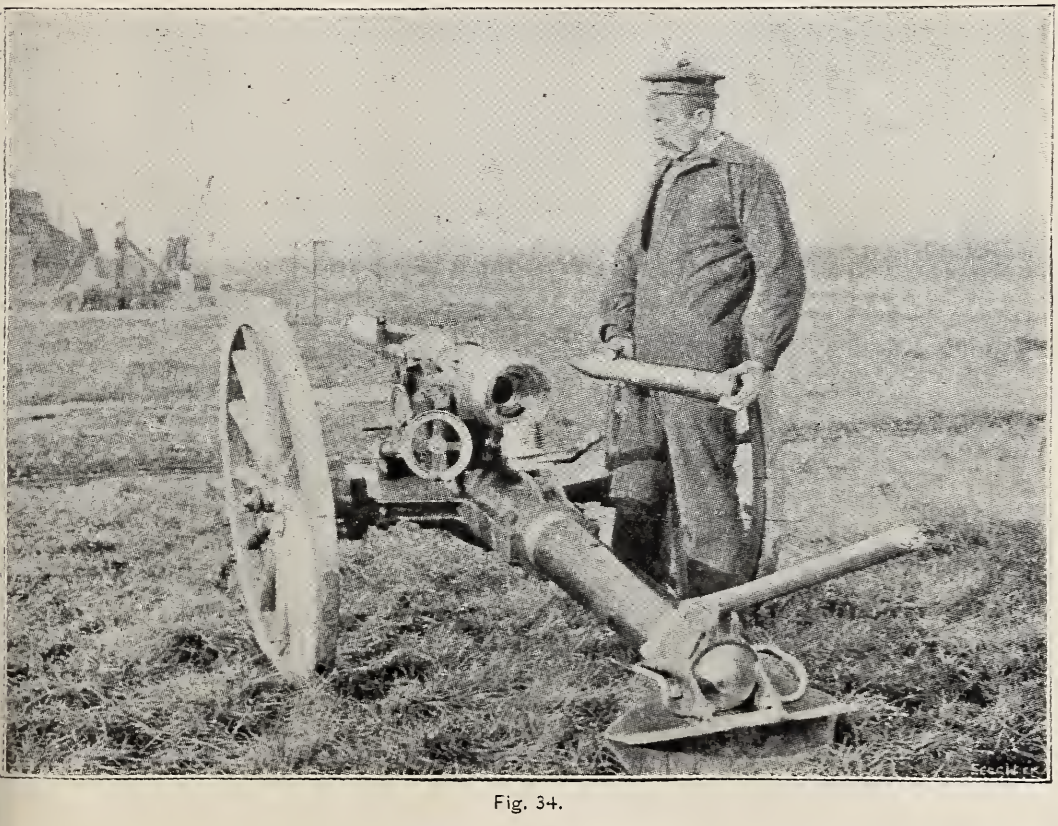


Fig. 34.

CANET FIELD GUN FOR JAPAN.

London Engineering.

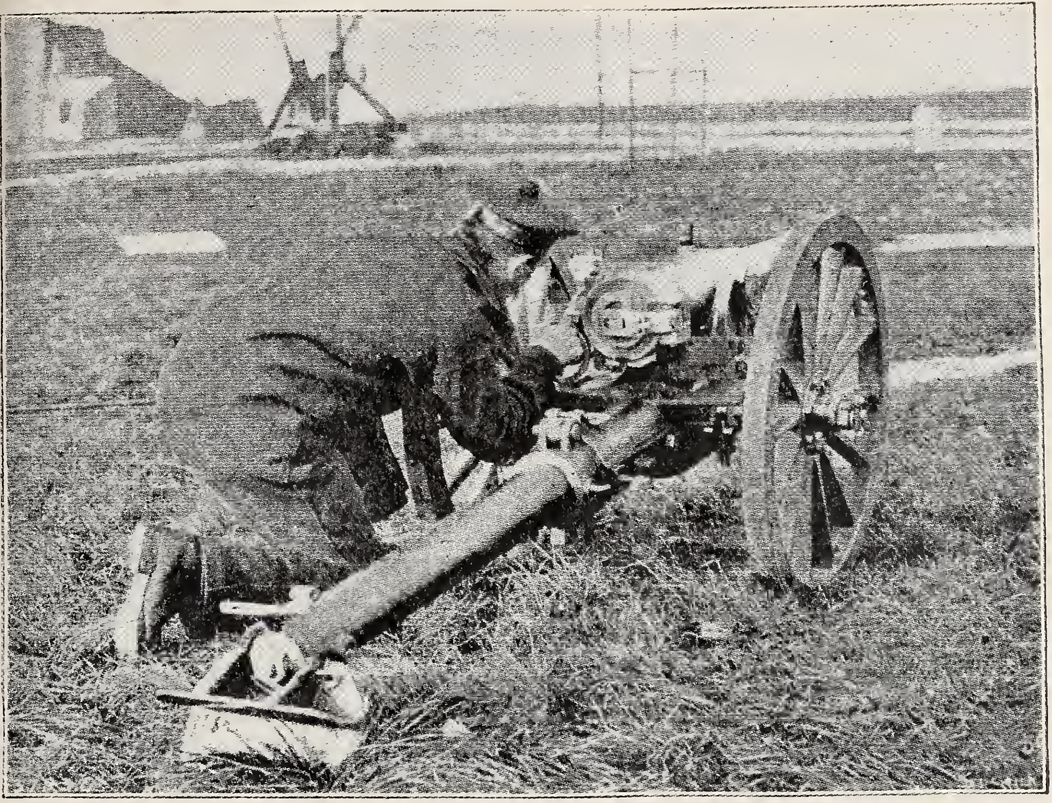


Fig. 35.

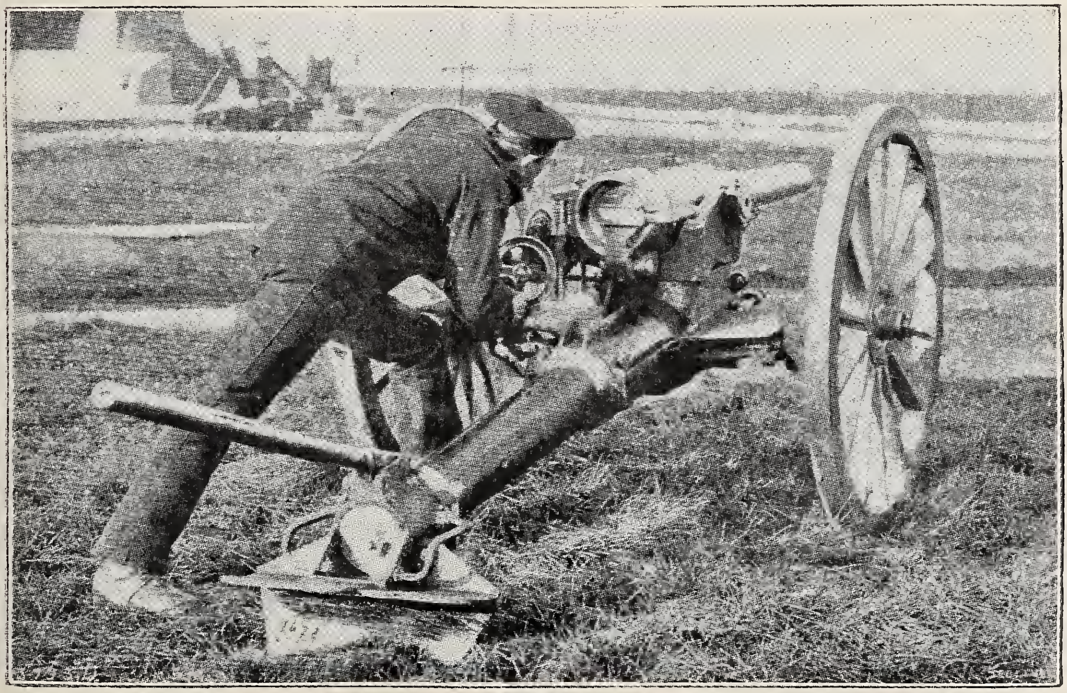


Fig. 36.

CANET FIELD GUN FOR JAPAN.

London Engineering.

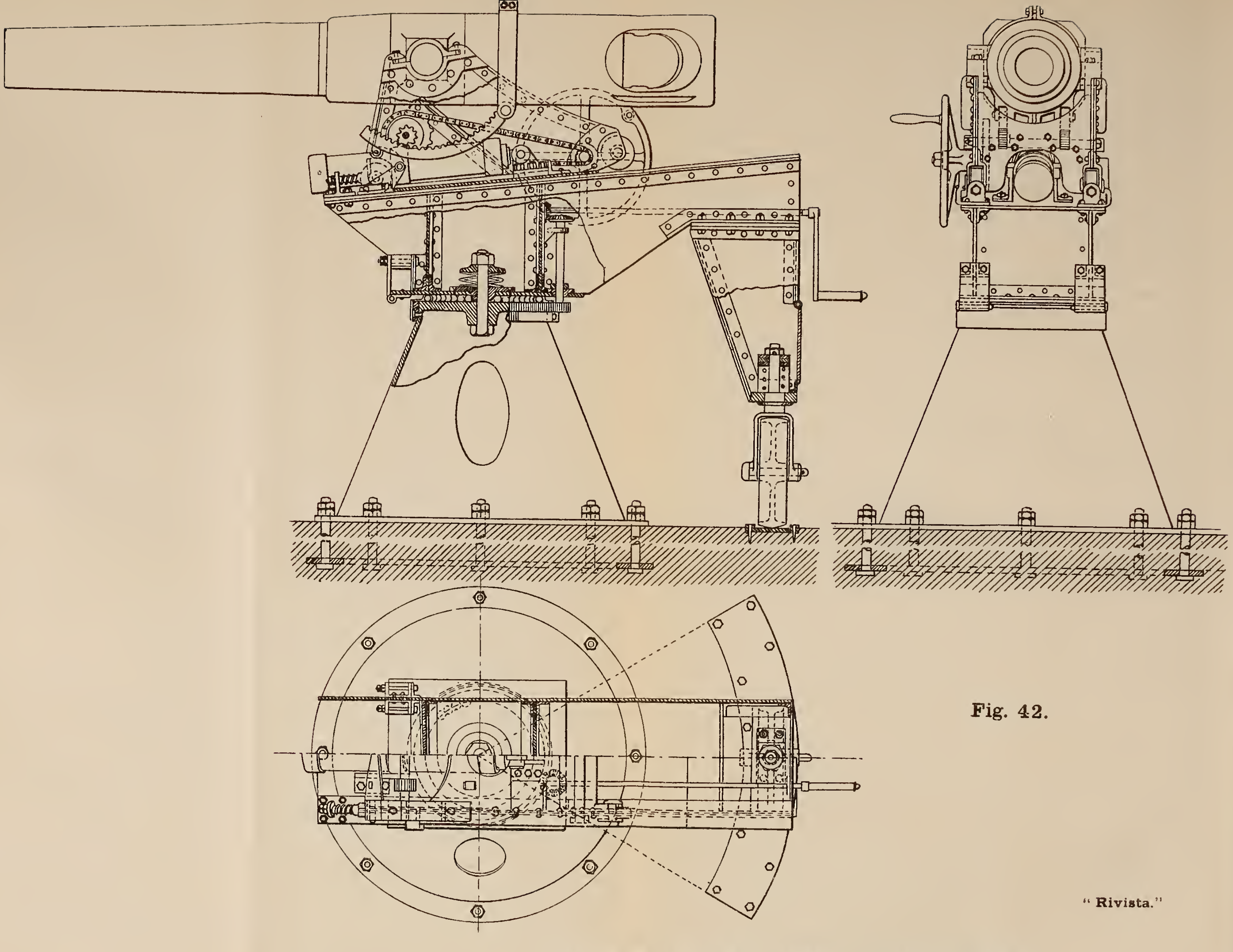


Fig. 42.

" Rivista."

SIEGE MOUNT FOR FIELD GUNS (RUSSIA).

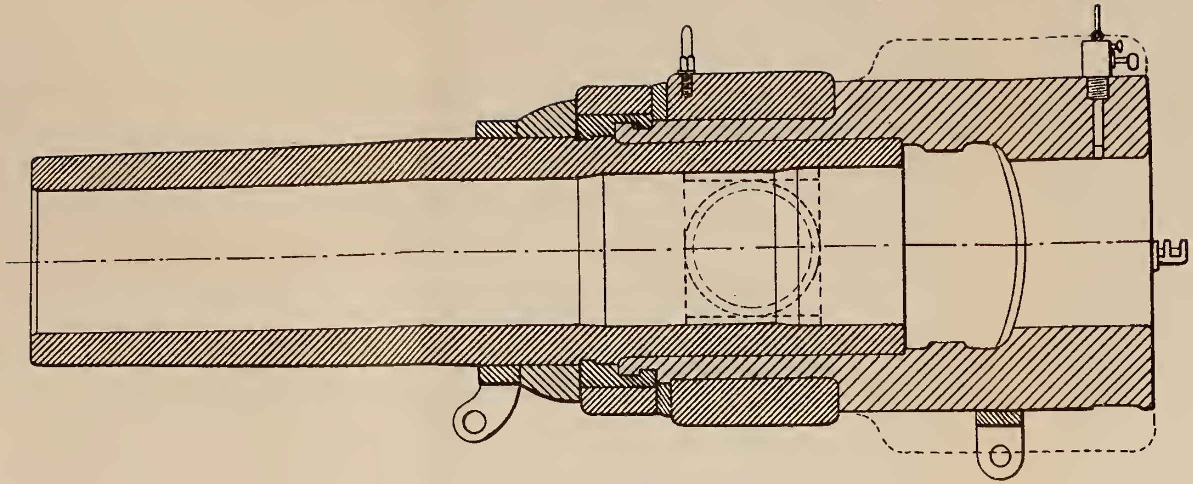


Fig. 37.

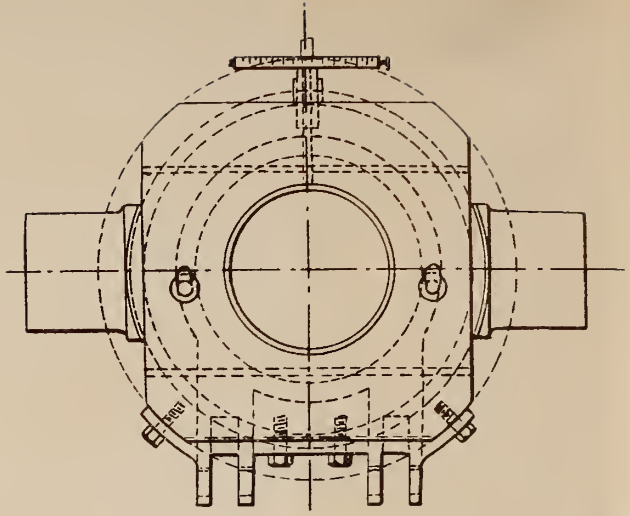


Fig. 38.

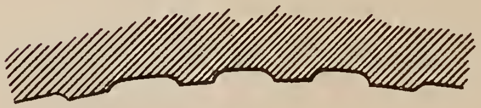


Fig. 40.

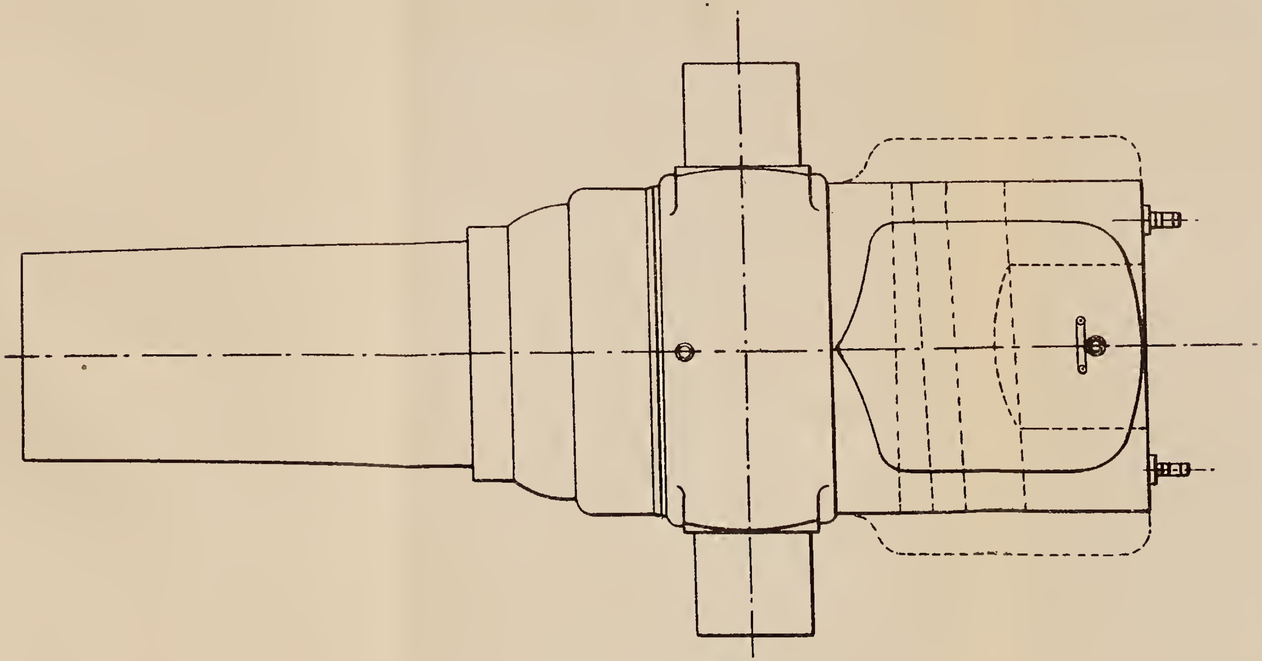


Fig. 39.

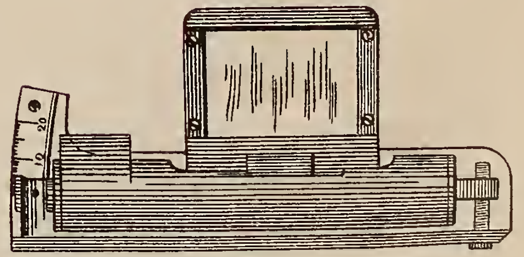


Fig. 41.

9 IN. B. L. R. MORTAR (RUSSIA).

“Rivista.”

is 5 degrees 16 minutes, and the final angle is 11 degrees 50 minutes. The mortar, including plug, weighs 3,904 pounds (figs. 37, 38, 39, and 40). To facilitate in pointing, a reflecting quadrant (fig. 41) is provided.

GUN CARRIAGE FOR MOUNTING FIELD GUNS IN FORTIFICATIONS.

This mount for field guns when temporarily used in fortifications was proposed by Colonel Durlacher and adopted by the Russian Government in December, 1895. It has a central pivot and a cone base. The particulars are clearly shown in the drawings (fig. 42). The total weight of the mount, including cone, is 1,698 pounds—the cone weighs 362 pounds. This mount permits a maximum elevation of 10 degrees and depression of 5 degrees.

SPAIN.

R. F. MOUNTAIN GUNS.

The Spanish Government has recently purchased of Krupp a number of mountain guns for use in Cuba. The gun (fig. 43) is of 7.5 centimeters (2.95 inches) caliber and is made of steel. The rifling is progressive. The breech closure is a modified form of the Krupp wedge, and fixed ammunition is used. The plug contains the firing mechanism, which is automatically cocked in turning the lever in opening the breech. The gun is fired by means of a lock string. The empty cartridge case is ejected by an extractor, which is operated by the opening of the breech.

The carriage (figs. 48 and 49) is entirely of steel, with the exception of the wheels, and has these principal parts:—

1. The trail piece, which can be disconnected from the rest of the carriage.
2. The recoil brake, consisting of a claw, or spade, which takes in the ground and bears against a spring in the foot of the trail piece. (Figs. 48 and 49.)
3. The trunnion seats, both in one piece, are separate from the main body of the carriage and turn about a vertical pivot to permit training.

This gun uses three kinds of projectiles: Shell with percussion fuze (fig. 44), shrapnel with combination fuze (fig. 45), and canister (fig. 46).

The cartridges are loaded with 5.85 and 6.7 ounces of W. P. C. 189 smokeless powder, which give, respectively, 900 and 984 foot-seconds initial velocity and 23,354 and 27,422 pounds per square inch mean pressure.

For transportation the gun and carriage are arranged in four packs, the ammunition being taken in separate packs. (Figs. 50, 51, 52, and 53.) A first mule carries the gun, the second the body of the carriage, the third the trail piece and the shafts, the fourth the axle and wheels; each ammunition mule carries two ammunition boxes of six cartridges each (fig. 54).

The following particulars are given:

Gun:—		
Caliber	inches	2.95
Total length	do calibers	32.48 11
Length of bore	inches	25.8
Depth of rifling	do	.0295
Width of rifling	do	.233
Width of lands	do	.984
Diameter between lands	do	2.95
Initial twist	do calibers	132.9 45
Final twist	inches calibers	73.8 25
Length between sights	inches	20.7
Capacity of powder chamber	cubic inches	33.56
Capacity of bore	do	178.8
Total weight of gear, including plug	pounds	233.7
Preponderance	do	39.7
Carriage:—		
Weight, including axle and wheels	pounds	621.7
Weight, with gun	do	855.4
Weight of main body	do	242.5
Weight of trail piece	do	172
Weight of axle and fittings	do	57.3
Weight of each wheel	do	75
Weight of shafts	do	41.9
Length of body	inches	38.8
Length of trail	do	46.3
Length of axle	do	42.1
Heigth of axis of trunnions	do	25
Diameter of wheels	do	31.5
Width between wheels	do	32.7
Extreme angle of elevation	degrees	20
Extreme angle of depression	do	10
Ammunition boxes:—		
Length	inches	17.6
Width	do	9.5
Height	do	14.7
Weight, empty	pounds	38.8
Capacity (number of cartridges)		6
Weight of ammunition, per box	pounds	91.9
Total weight	pounds	122.8
Ammunition:—		
Weight of loaded shell or shrapnel with fuze	pounds	13.2
Weight of bursting charge { Shell	ounces	5.4
Weight of bursting charge { Shrapnel	do	3.2
Number of balls in each shrapnel		225
Weight of each ball for shrapnel	ounces	.388
Weight of fuzes { Percussion for shell	ounces	4.4
Weight of fuzes { Compound for shrapnel	do	16.2
Number of balls in each canister		310
Weight of each ball for canister	ounces	.56
Weight of charge	do	5.85
Weight of cartridge case	do	26.5
Weight of cartridge complete, shell and shrapnel	pounds	15.3
Weight of cartridge complete, canister	do	16.4

Ballistic data:—

Initial velocity	foot-seconds	902
Angle of jump	minutes	32
Muzzle energy	foot-tons	74.72
Muzzle energy per pound weight of gun and carriage	foot-pounds	195.6
Distance corresponding to the maximum of the time fuze	yards	3,900

Range table.

Distance.	Angle of elevation.		Angle of fall.		Remaining velocity.
Meters. Yards.	°	′	°	′	*f. s.*
500 = 547	1	19	2	3	860
1,000 = 1,094	3	22	4	19	820
1,500 = 1,641	5	39	6	51	784
2,000 = 2,188	8	10	9	46	751
2,500 = 2,735	10	55	13	2	722
3,000 = 3,281	13	56	16	46	695
3,500 = 3,828	17	19	21	1	676
3,900 = 4,263	20	21	24	49	663

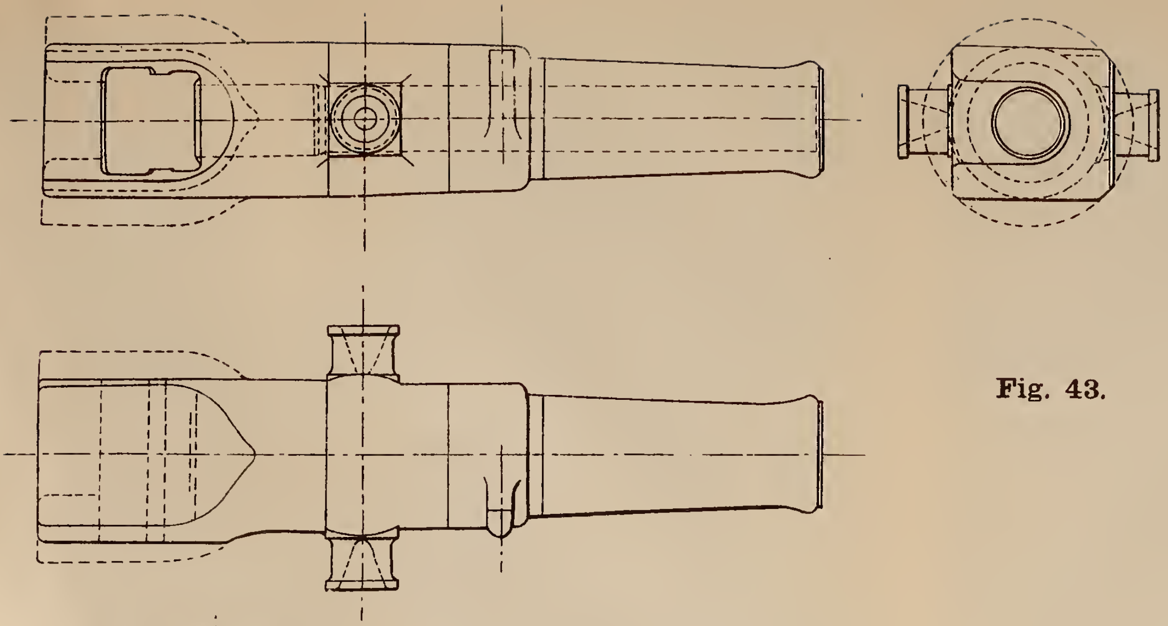


Fig. 43.

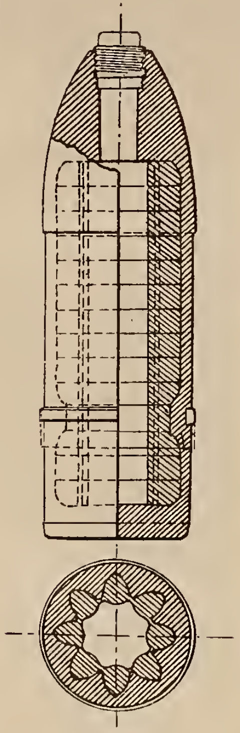


Fig. 44.

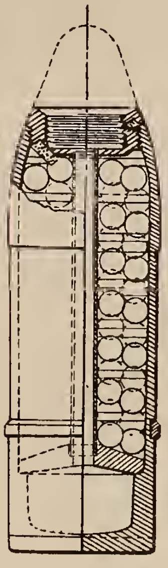


Fig. 45.

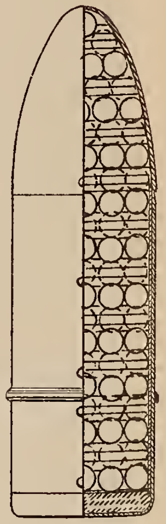
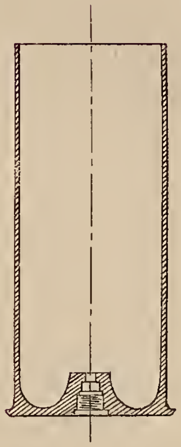


Fig. 46.



"Rivista."

Fig. 47.

SPANISH MOUNTAIN GUN AND AMMUNITION.

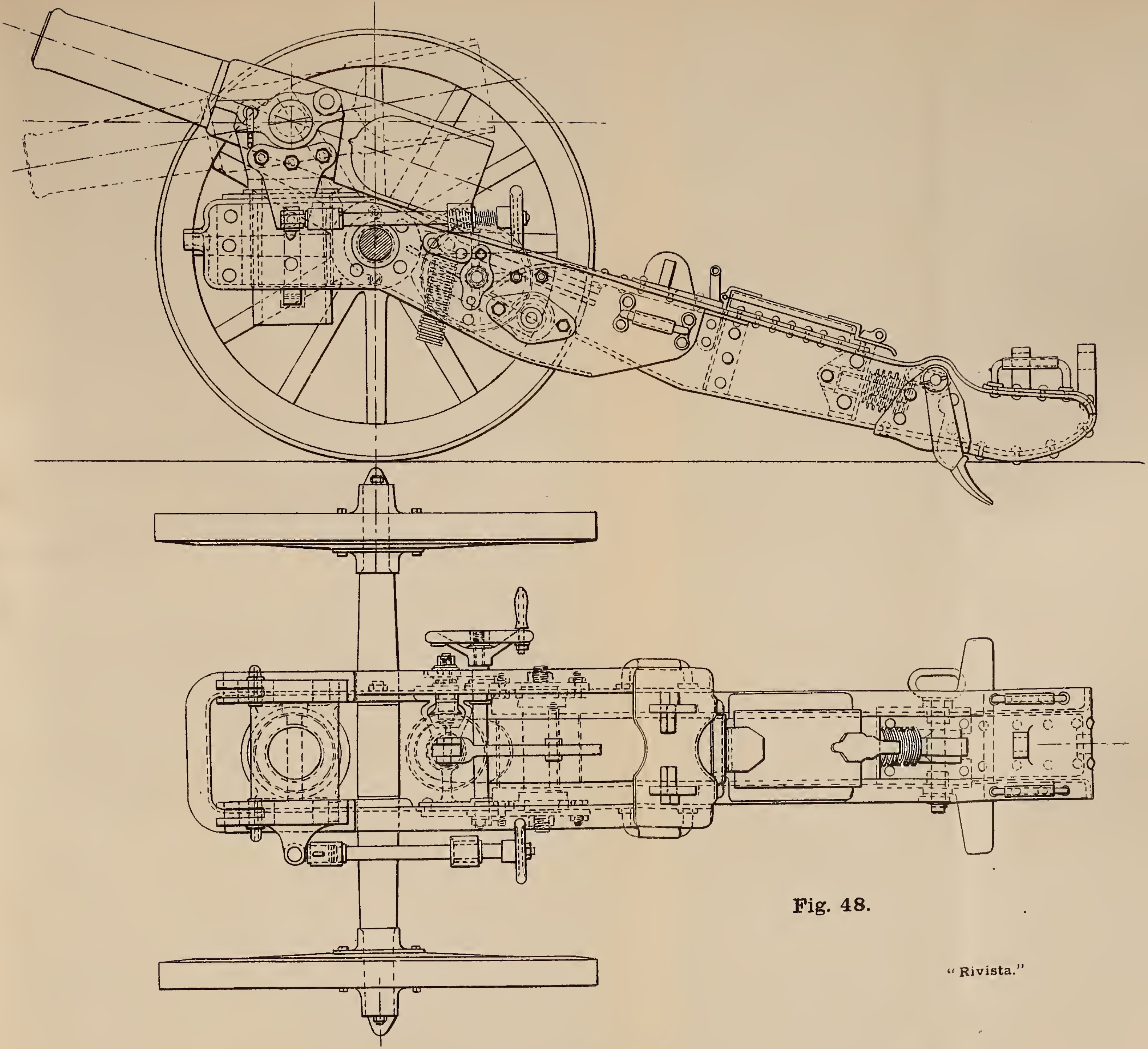


Fig. 48.

“Rivista.”

SPANISH MOUNTAIN GUN CARRIAGE.

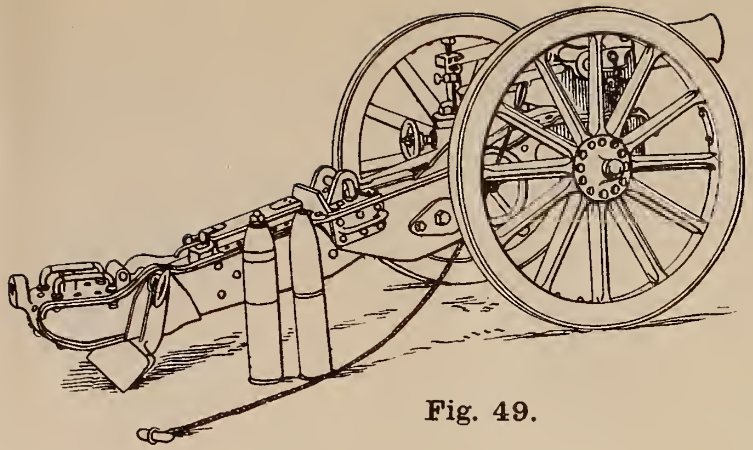


Fig. 49.

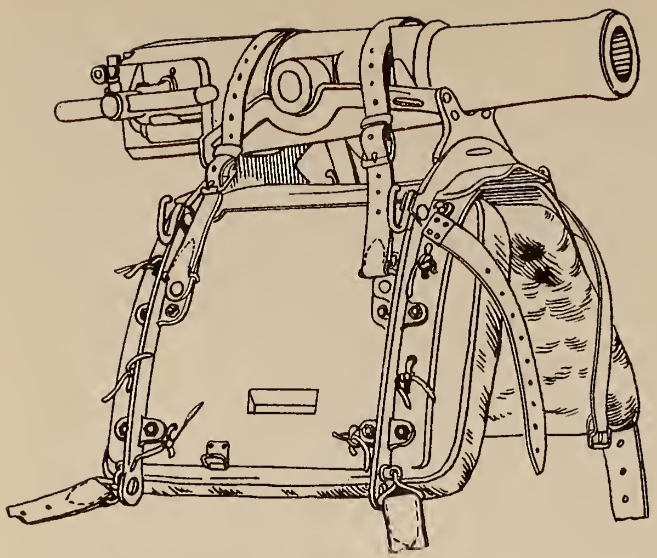


Fig. 50.

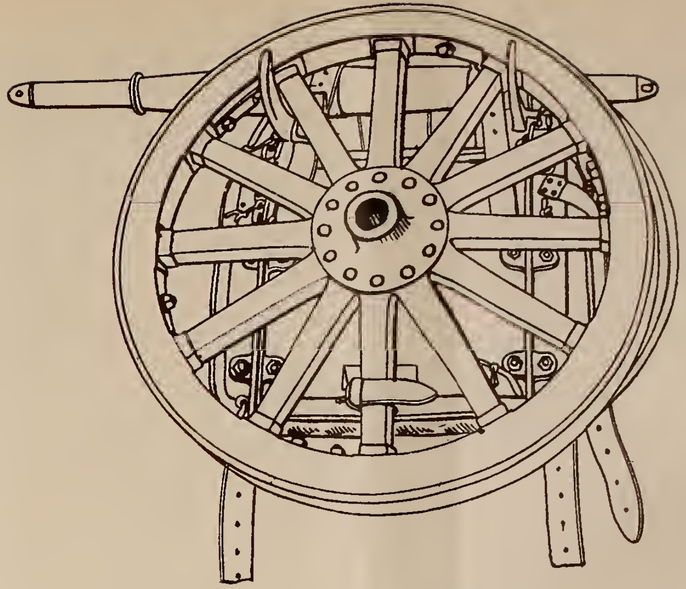


Fig. 51.

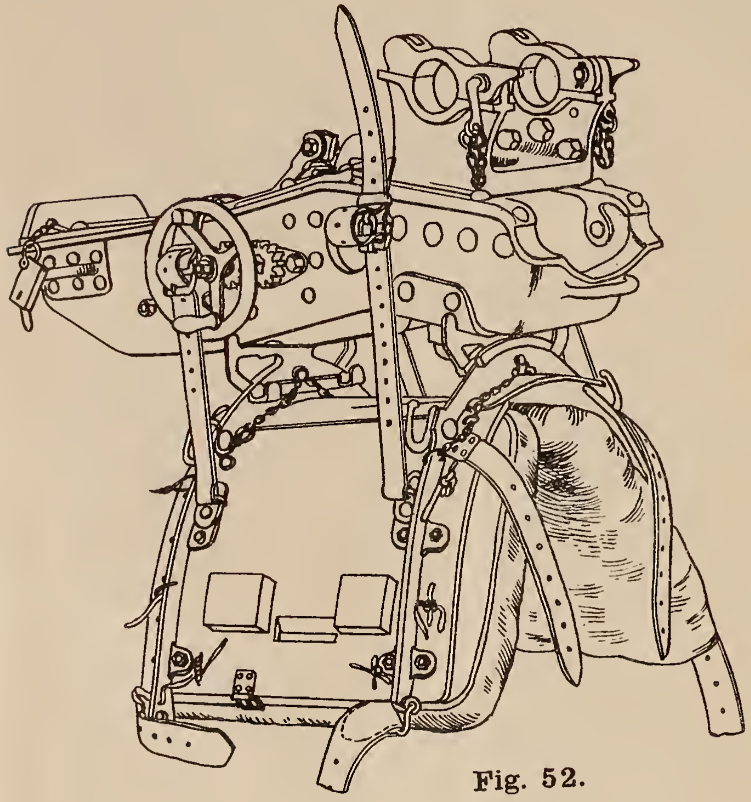


Fig. 52.

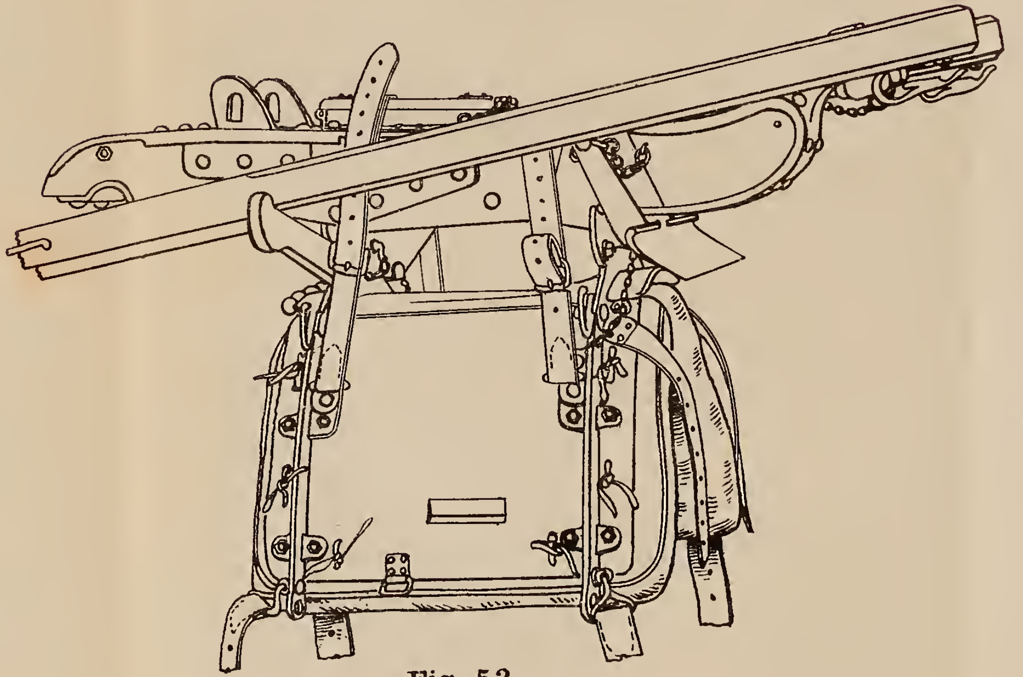


Fig. 53.

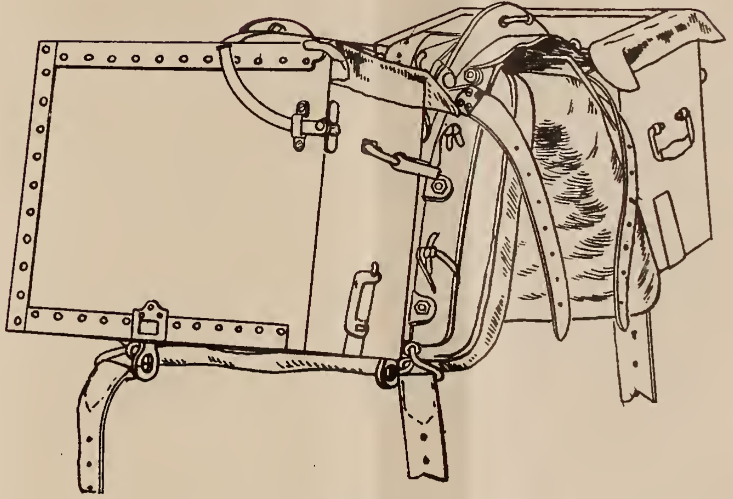


Fig. 54.

SPANISH MOUNTAIN GUN IN PACKS.

V.

NOTES ON SMALL ARMS.

By Ensign LAY H. EVERHART, United States Navy,
Staff Intelligence Officer.

For a number of years there has been much uncertainty as to what was the best caliber for military rifles, and the best authorities have differed widely on this point. Great stress has been laid on the stopping effect, and this has been one of the chief arguments against extremely small calibers, which, it has been claimed, lack in this respect.

However, it has been taken for granted that the future development of small-arm rifles would include a reduction in caliber, which means a reduced weight of ammunition and a flatter trajectory, the limit to this reduction in caliber being controlled by the difficulties of manufacture, of burning enough powder, of getting a barrel to stand the wear, and of getting a bullet that will not strip its envelope.

The latest arm on the European market is the Mannlicher 1896 model of 6-millimeter caliber manufactured by the Austrian small-arms factory. It is thought that a further reduction in caliber will require a bullet of some metal without covering, such as wolfram or tungsten.

The automatic working of the bolt finds advocates for its use in military rifles, not only to increase the rapidity of fire, but to lessen the work done by the rifleman; but it is very questionable whether a rifle of such a nature would be efficient under service conditions.

AUSTRIA.

After many experiments extending over several years and including calibers as small as 4 millimeters, the Austrian small-arms factory has finally decided on what is known as the Mannlicher 1896 model of about 6-millimeter caliber (actually 5.95 millimeters or .2343 inches). The initial velocity of the new arm is 770 meter-seconds (2,526 foot-seconds) and the weight complete 7.7 pounds without the bayonet, which weighs .75 pounds. A marked improvement over other rifles has been made in the greatly reduced proportions of the breech mechanism, which at the same time is said to be stronger and more durable. The bolt is locked into the breech by four studs, thus reducing the chances of accident through imperfections in the metal. The bolt is but .57 inch in diameter and the number of parts have been reduced.

The cartridges are loaded into the magazine in clips of five, and in case some have been fired, individual cartridges may be inserted to fill the magazine. The clips weigh 115.7 grains. The stock completely surrounds the barrel, and an improved attachment for the bayonet is provided.

GREAT BRITAIN.

THE NEW LEE-METFORD BULLET.

The claim that the original Lee-Metford bullet lacks in stopping effect has led to the production of a new bullet, which, it is thought, will be adopted by the British Government. This bullet, which is similar to the Tweedie bullet, is of the same shape as the old one, has its hollow base lined by the jacket, the jacket at the point is made thin, and the lead core is slightly exposed, the lead being filled in from this end, the idea being for the bullet to upset or mushroom on striking an object, and thus increase the size of a wound. The following account of experiments conducted at Dumdum, India, is given in the Broad Arrow:

The experiments consisted in firing at different objects, such as planks in rear of each other, bags of coal, sandbags, tins of dry and moist sand, and wine cases, divided into three compartments filled with earth. One butt was especially devoted to carcasses of sheep. All the objects were fired at with the present bullet and the new bullet, except the sheep, which were only fired at with the new bullet. The result fully justified Colonel Hill's confidence in the new bullet, and the difference in the holes made in the various objects and the amount of mushrooming in each case was very marked. The service bullet was found to have drilled clean holes, and where penetration was complete the hole of exit was little, if any, larger than the hole of entry, and the bullet itself was not deformed, only showing the marks of the rifling, but the exit holes made by the new bullet were much larger; and although the penetration was sufficient, the bullet was either mushroomed or the nickel jacket and lead had parted company. The wounds made in the carcasses of sheep showed that the destruction of bone and tissue perforated by the new bullet was tremendous, and conclusively proved the stopping powers of the bullets.

THE RICCI AUTOMATIC GASTIGHT REVOLVER.

This revolver is rendered gastight by the cartridge case, which extends beyond the bullet, being partly driven forward from the cylinder into the barrel before firing, thus utilizing the powder pressure throughout the length of the barrel.

The operations of loading, extracting the empty case, and cocking the firing pin are performed automatically by the pressure on the face of the plunger at the moment of explosion.

In fig. 1, D is the cylinder; E the plunger; F the firing pin, which is in the center of the plunger; J a two-branch spring, one of which J operates the plunger and the other J′ the striker, and both are employed in resisting the backward pressure at the moment of discharge; L the lever, carrying the pawl T for rotating the cylinder, pivoted at *m;* and the sear M pivoted at *m*. The mechanism for insuring single firing consists of the trigger H hinged at G, carrying a tumbler K hinged at *g*, and gearing at K′ with a shoulder E′ of plunger E. *h* is a spring that operates both the trigger H and tumbler K. R is a spindle made solid with the handle S, which is on the outside of the revolver and serves for locking the sear M, thus preventing accidental discharge. Q is the ordinary pawl for holding the cylinder in place. O is a spindle connected by the handle P, by which the tension of the mainspring J is eased when the revolver is not in use. U is a lever on the outside of the revolver connected with the pivot *m*, which has a projection V gearing with the plunger E, and serves for loading the first turn and working the revolver by hand.

The spindle R is cut just opposite the sear M, so as to allow the latter enough room to work on its pivot *m* when the spindle R is in the position shown and the lever S is upright. When, however, the lever is turned to the position S′, the spindle bears against the sear M, rendering it immovable and thus locking the revolver.

The action of the revolver is as follows: By pulling the trigger the firing pin is released by the sear M through the tumbler K and the cartridge is fired. The powder pressure developed drives the plunger and firing pin backward against the two branches of the spring J at the moment the bullet leaves the muzzle. This movement extracts the empty cartridge case from the barrel, cocks the firing pin in the position shown in fig. 1, and the shoulder E′ of the plunger gearing with the head K′ of the tumbler K puts the latter out of gear with the sear M, which then returns to its normal position, holding the firing pin in the cocked position. As soon as the energy of recoil of the plunger has been absorbed by the spring J, the latter will instantly react, returning the plunger to the front. During this forward movement of the plunger the shoulder *f* of the lever L (which was forced upward during the backward motion of the plunger by the spring *n*) comes in contact with the shoulder *e* of the plunger and causes the lever L to turn downward and rotate the cylinder, by means of pawl T, through one space. The rotation of the cylinder causes the empty cartridge case to slide out of the two extractors of the plunger and a fresh cartridge to be brought opposite the barrel and then thrust in by the plunger, when the revolver will be ready for another shot. It is evident that a round will be fired simply by pulling and releasing the trigger at each shot. The spring J is of such strength that the bullet will have left the muzzle before the empty case is fully extracted from the barrel.

The form of this revolver shown in fig. 2 is so constructed that it may be operated either automatically or by hand. In general, it is like that illustrated by fig. 1, with the difference that the recoil is taken up by one flat spring and one spiral spring, the latter taking up the recoil through a system of two links and a thrust piece.

N is the thrust piece pivoted at q and takes the recoil through the plunger. The upper link O is hinged at N^2 to the thrust piece and at P' to the lower link P, the latter being pivoted at P^2. The spring X is connected to the lower link by the pin X'. P^3 is a projection on the link P bearing against the slide V and keeping the center P' below the line N^2P^2 when working automatically, so that the recoil of the plunger is taken by the spring X. When, however, the lever U is rotated to the position shown by the dotted lines, the slide V is withdrawn and the projection P^3 will bear against the frame of the pistol bringing the center P' above the line P^2N^2 so that there will be no recoil of the plunger, the thrust being taken by P^2. The plunger will therefore have to be withdrawn by hand by the tailpiece O'. The action of this revolver can now be clearly seen.

The cartridge cases used for this revolver are grooved (fig. 3) and slightly conical, with the case prolonged to the extremity of the bullet, and have thick walls to prevent explosion.

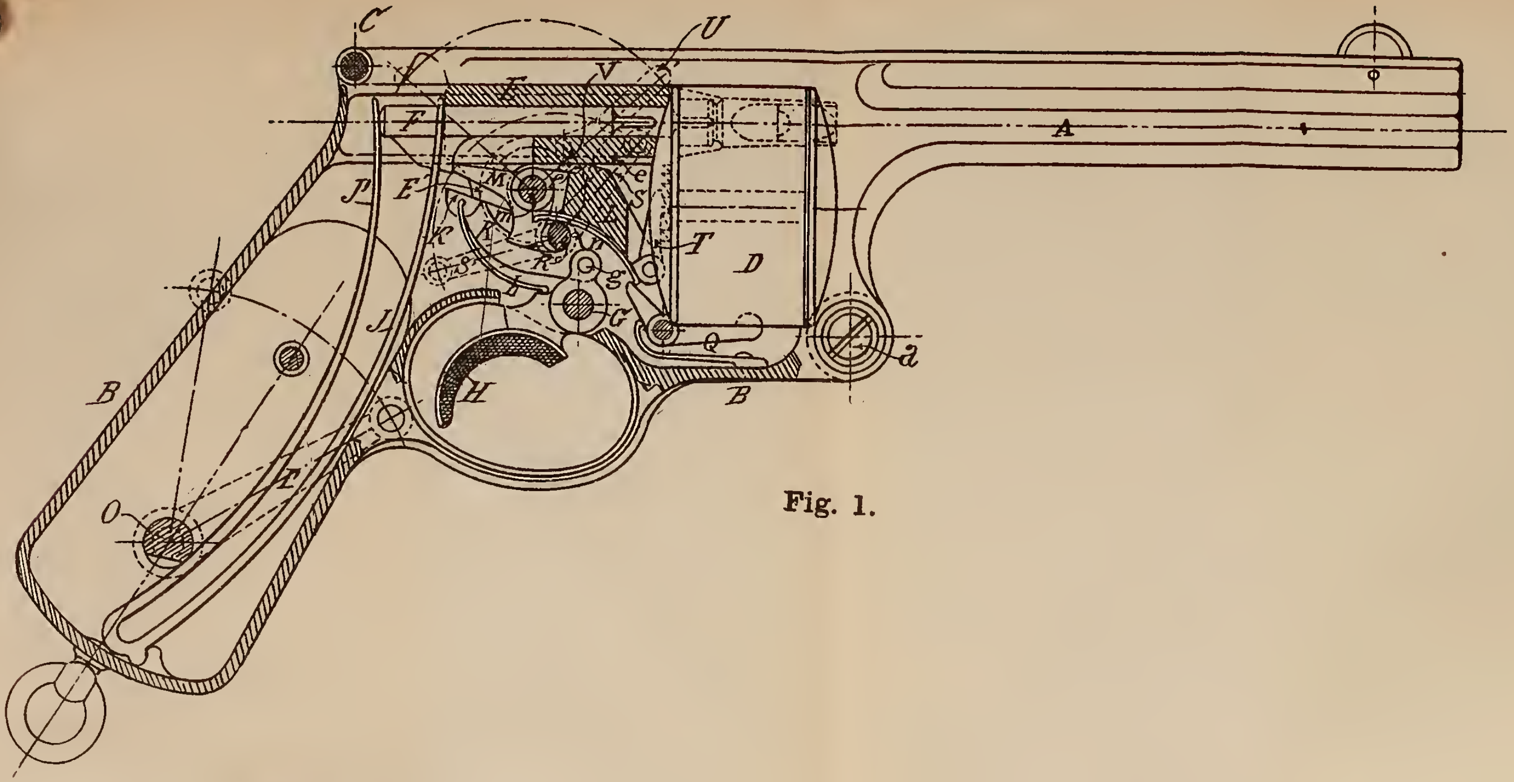


Fig. 1.

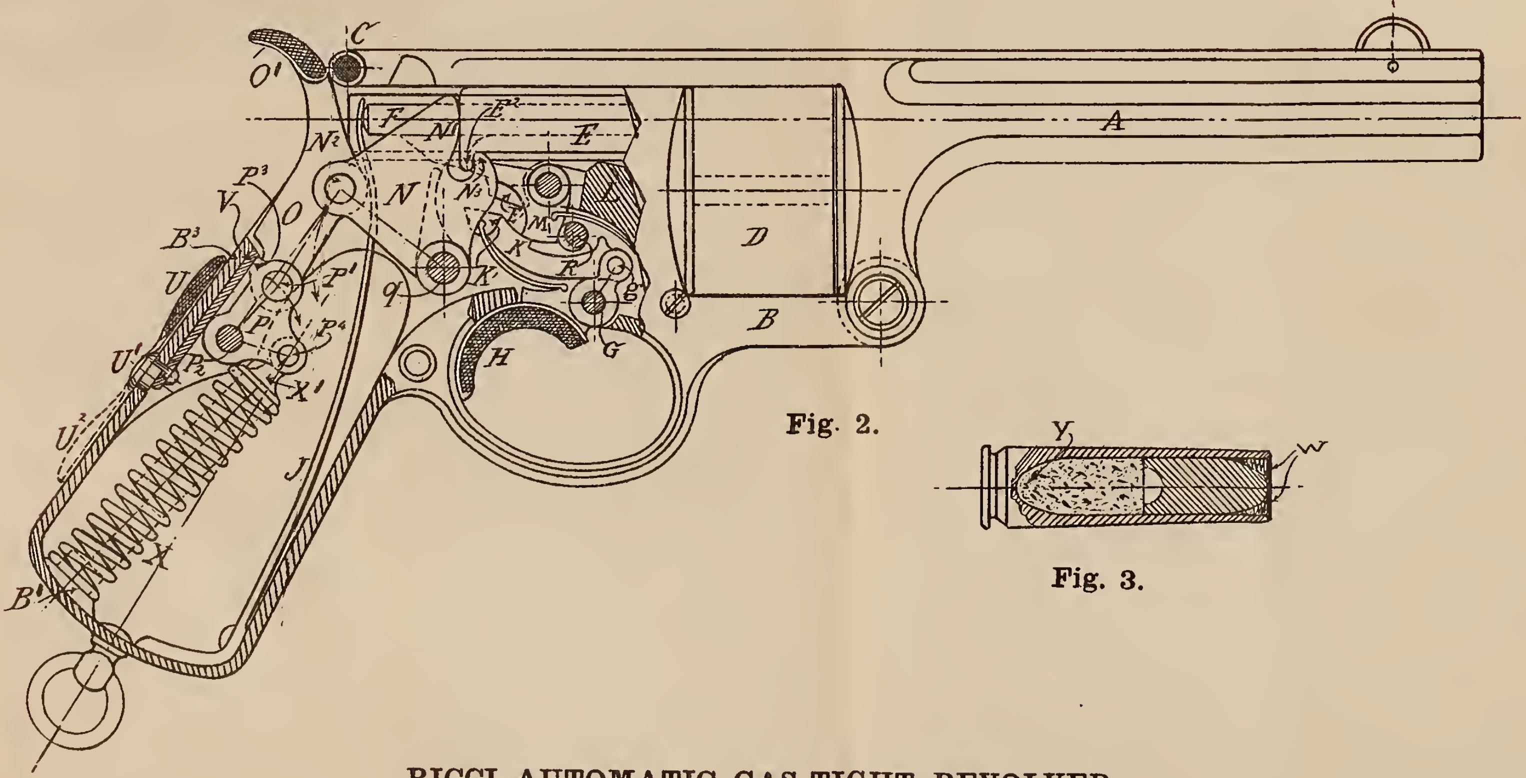


Fig. 2.

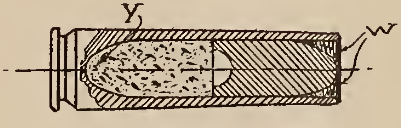


Fig. 3.

RICCI AUTOMATIC GAS-TIGHT REVOLVER.